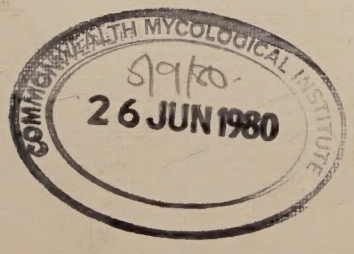
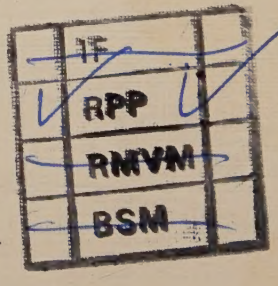
annual report

department of agricultural technical services





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REPUBLIC OF SOUTH AFRICA

ANNUAL REPORT

of the

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Report of the Secretary for Agricultural Technical Services for the period 1 July 1978 to 30 June 1979

THE HONOURABLE THE MINISTER OF AGRICULTURE,
PRETORIA

SIR,

I have the honour to submit herewith the Annual Report of the Department.

Secretary for Agricultural Technical Services

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I. Introduction

TRAINING AT AGRICULTURAL COLLEGES

The challenge of providing food for South Africa's exceptionally rapidly growing population is in fact a challenge to the farmer. Or, more specifically, it is a challenge to the knowledge, expertise and technological insight of the future generation of farmers.

However, the fact is that only 9,4% of farmers enjoyed any type of training after matriculating - despite the fact that it is today generally realised that farming is a complicated, demanding undertaking which is frequently practised under conditions unfavourable to most aspects thereof.

Thorough tertiary training of agricultural producers has become imperative to the industry because of the greater demands made on the producer by current and expected conditions.

The Department of Agricultural Technical Services fulfils a large and important task in this respect by training prospective farmers at its five colleges of agriculture in the four provinces, and has a proud record in this respect. Farmers who have obtained diplomas at these colleges have, over the decades, in many instances come to the fore as leaders in the sphere of agriculture and are also frequently among the most efficient producers.

The following table shows the number of students who have obtained diplomas at the agricultural colleges since their inception:

Number of diplomas awarded since the inception of the colleges of agriculture

Elsenburg	2 513
Grootfontein	2 116
Glen	1 858
Potchefstroom	1 804
Cedara	1 694
Total	**9 985**

TRAINING OF PROSPECTIVE FARMERS AS A TASK OF THE DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES

The training of farmers, whether by means of diploma courses or short courses, had become an accepted technical service even before research and extension were placed on a firm footing by the authorities.

In the first year after Union in 1910, the agricultural colleges were transferred to the Department of Agriculture and agricultural college training has been one of the tasks of this department ever since.

By 1910 the first college of agriculture - Elsenburg - was already 23 years old. Other institutions such as agricultural schools, universities and, later, Technikons, also made an important contribution towards the training of farmers over the years.

The Department undertakes agricultural college training - as it does extension and other forms of agricultural development - on an agro-ecological basis. Just as every Regional organisation has its own service area with regard to agricultural development, every agricultural college accepts training obligations towards farmers of that particular Region.

The Department has the necessary expertise and facilities to carry out this task to the full. There is also very close liaison between lecturers at the colleges and their research colleagues so that training never falls behind the latest technological developments.

The oldest college of agriculture in the country is that at Elsenburg which came into being in 1887. The Potchefstroom College of Agriculture was started just before the Second War of Independence and the Cedara College of Agriculture immediately after this war. The Grootfontein College of Agriculture came into being shortly after Union, in 1911, while the youngest of the colleges, Glen, enrolled its first students in 1919.

Elsenburg provides in the training requirements of farmers in the Winter Rainfall Region. The choice of subjects at Elsenburg allows the student to choose among three courses, namely Crops/Animal Science or Viticulture/Animal Science or Viticulture/Pomology/Crops. There is also a course in Cellar Technology.

The Grootfontein College of Agriculture serves the Karoo and Eastern Cape Regions of the Department, an area where 56% of the goats and 35% of the sheep population of the Republic are found. At this college the emphasis falls on small stock production, and more particularly on wool production.

The Glen and Potchefstroom Colleges of Agriculture serve the more intensive livestock regions of the northern parts of the country.

The courses at these two colleges place equal emphasis on the crop and livestock industries.

From the beginning of 1980 the course at Potchefstroom has been modified so that students in the second year can specialise in either crops or livestock.

The Cedara College of Agriculture serves the Natal Region, an area with a unique climate and one which is characterised by the practise of a wide range of different branches of agriculture.

Standardisation of the courses

During the past 3 years the curriculum of particular subjects such as Basic Crop Production, Basic Animal Production, Soil Science, Agricultural Economics and Agricultural Organisation were subjected to a process of standardisation to ensure that all colleges offer the basic subjects at the same level.

Insofar as it is practical and insofar as the ecological differences between the service areas of the colleges permit, supportive subjects such as Agricultural Engineering, Animal Health and Pasture Science were also standardised.

Contents of courses at colleges of agriculture

The following total list of subjects offered at the five colleges gives an idea of the wide field which is covered.

COURSES AT COLLEGES OF AGRICULTURE

SUBJECT

Basic Animal Production I:

- Feeding
- Breeding
- Physiology

Basic Animal Production II:

- Genetics

Karakul Production

Small Stock Production I

Small Stock Production II

Small Stock Production III:

(a) Mutton Sheep and Boer Goats
(b) Merino Sheep
(c) Wool Technology
(d) Sheep Management
(e) Sheep Feeding
(f) Sheep Breeding and Performance Testing

Small Stock Production in the Winter Rainfall Region

Beef Cattle Production

Large Stock Production:

(a) Beef Cattle (i)
(b) Dairy Cattle
(c) Milk Production (i)
(d) Pigs (i)
(e) Poultry (i)
Poultry (ii)
(f) Horses

Animal Health

Basic Crop Production I

Basic Crop Production II

Crops:

- Winter Rainfall
- Summer Rainfall

Deciduous Fruit Production

Viticulture

Vegetable Production

Crops:

(a) Summer Rainfall
(b) Karoo
(c) Other Fruit
(d) Winemaking
(e) Horticulture: General
(f) Tobacco
(g) Forestry

Soil Science

Soil and Soil Science (Karoo)

Pasture Science:

(a) Grassveld (i)
(b) Karoo and Fynbos
(c) Bushveld
(d) Cultivated Pastures and Radical Veld Improvement (i)
(e) Veld Reclamation: Drought crops, Invader Plants, and Poisonous Plants

Engineering

Agricultural Economics

Labour Care

Agricultural Organisation

The current capacity of agricultural colleges is given in the following table:

Capacity and numbers enrolled

	Maximum number of students	Number of new intakes in 1979
Elsenburg	156	82
Potchefstroom	133	78
Cedara	150	72
Grootfontein	110	55
Glen	120	65
Total	**669**	**342**

FUTURE OF AGRICULTURAL COLLEGE TRAINING

The need for training in an industry

characterised by rapid technological development and increasing management demands, is obvious. The Department again took steps recently to maintain this form of training on a sound basis.

During 1977 a departmental committee of enquiry found that the capacity of the existing colleges of agriculture will have to be doubled within the next 5 to 10 years to keep pace with the increasing demand for agricultural college training.

This finding is based firstly on the number of potential students who apply for enrolment every year but who cannot be accommodated, and secondly on the necessity that a greater percentage of the Republic's farmers *should* receive post-school training in agriculture.

During the past 3 years a start was made with an expansion program at Elsenburg, Cedara and Potchefstroom. For example, a new hostel is under construction at Elsenburg which will provide additional accommodation to 90 students, while a new hostel which will accommodate 150 students has just been taken into use at Cedara.

The total building program, including lecture halls, came to nearly R4,5 million and will be completed in the near future.

Additional accommodation for 100 students is also being planned for Potchefstroom, apart from the completely new classroom complex and administrative facilities that are already under construction. The latter expansions will come to about R1 140 000.

New classrooms, a hall and an office complex for the present 120 students at Glen were taken into use in 1978.

An important further development in view of the envisaged doubling of agricultural college facilities, is the planning of a sixth agricultural college at Nelspruit. According to the planners students will be able to enrol for courses here in 1985. The courses at this college will mainly be aimed at the cultivation of citrus, the major subtropical crops, vegetables, sugar-cane, tobacco and cotton.

Although applications for admission indicate a doubling of student numbers within the next 5 to 10 years, expansion must continue to proceed on a rational basis. The number of farmers who enter active farming within every college's service area every year, is regarded as a sensible basis for calculating the creation of training facilities.

If calculations are made on this basis, it implies that about 100 candidates must complete their studies at each of the six colleges every year in order to provide *one quarter* of the new farmers with diploma training.

Informal training

From the history of the agricultural colleges it appears that the need for informal training of farmers has always been a strong motivating factor in the creation of the agricultural colleges.

Through the years the colleges have made a tremendous contribution in the field of informal training.

The extent of this task which is carried out annually in addition to student training, is shown in the following table:

Short courses at Agricultural Colleges during the year under review (1978/79)

Subject of short course		Number of courses	Number attending
(i)	Sheep and wool and wool classing	13	283
(ii)	Dairying, feeding, dairy cattle, cream testing, milk grading	12	418
(iii)	Beef cattle farming, Afrikaner cattle judging	3	147
(iv)	Artificial insemination	20	340
(v)	Farm business management	1	17
(vi)	Mechanisation, welding, tractor repair	4	48
(vii)	Pastures, feed planning, soilage cultivation	5	263
(viii)	Soil classification, cultivation, drainage	3	48
(ix)	Maize, dry beans, grain sorghum, grain grading	9	324
(x)	Pig farming	1	83
(xi)	Angora goats	1	20
(xii)	Other subjects	2	101
Total		**75**	**2 082**

The agricultural college, within the organisational frame-work of the Department, therefore fulfils a key function in the formal and informal training of farmers in South Africa.

Bearing in mind the Department's policy of guidance for the optimum use of natural resources - which includes human potential - the agricultural college is a vital link in the chain of agricultural development in the Republic.

II. Plant Production Improvement

FIELD HUSBANDRY

SUMMER CEREALS

MAIZE

Breeding

The past season was a good one for the breeding programme being conducted at Cedara. Yields of 108,5 quintals per ha were obtained at Kokstad.

The white high-lysine hybrid HL1 was released for production and seed was supplied to the companies that produce seed. HL1 was again evaluated at 70 sites where it performed outstandingly. In Malawi this hybrid showed great promise for the second year.

The inbred lines included in the newly released high-lysine hybrid HL1 again yielded exceptionally well in crosses, demonstrating their great promise.

Good progress was made in the search for a high-yielding yellow high-lysine hybrid. The experimental cross PO 940 Y outyielded HL1 on the average.

The development of photoperiod-insensitive populations from photoperiod-sensitive elite tropical material is meeting with considerable success.

Population and pure strain development

(a) The development of streak-resistant populations reached an advanced stage.
(b) Several breeding populations from the USA were evaluated locally during the past season. Many have excellent characteristics and could be incorporated in the South African breeding programme to great advantage.
(c) Several streak-resistant pure strains were developed and will be included in the national single crossing trials during the coming season.

Biochemical properties

The development of local sweetcorn pure strains with good quality characteristics has reached an advanced stage. A total of 700 kg of two experimental sweetcorn hybrids was produced during the past season for large-scale planting by the local canning industry in order to determine the quality of the new cultivars on a limited commercial scale.

Southern leaf blight *Helminthosporium maydis*

Extensive evaluation trials with 142 cultivars were undertaken during the season to determine whether the disease is a danger to the South African maize industry. (These trials were carried out in Natal by Prof. A.L. Hooker of the USA, who was brought to the Republic on contract by the Department to conduct this research on maize diseases and maize breeding.)

It was found that local material possesses sufficient resistance to protect the maize industry against this disease.

Breeding for resistance

The evaluation of cultivars was undertaken in order to determine susceptibility or resistance to boil smut *Ustilago maydis*. The method of artificial infection was so greatly improved that it was possible to obtain reliable results.

Considerable progress was made in producing effective resistance to streak and *H. turcicum* in all local breeding material, with the aid of the artificial infection techniques developed.

Ecology

Light traps for monitoring stalk borer moth flights were extended to serve four localities in the maize production area. It was found that the lowest number of moth flights in six years occurred during the past season.

Studies to relate moth flights to climatic factors showed that rainfall is the most important factor in determining the number of moth flights. The processing of data collected from field trials since 1973 revealed that, next to the number of moth flights, the planting date has the most important effect on the extent of the infections encountered by producers.

Nematodes

Soil fumigation trials were undertaken with nematocides and a further two that appear promising were found. Despite the protracted drought, yields were boosted by up to 29 per cent with the aid of soil fumigation in the Viljoenskroon area.

An analysis of nematode numbers in maize soils that was carried out by the Plant Protection Research Institute showed that nematode numbers increased until the end of March, but decreased rapidly after that.

Soil insects

Light trap catches in the vicinity of Frankfort showed that black maize beetle flights probably peak during two periods in each season.

The cutworm *Agrotis segetum* was shown to be the commonest species of cutworm in the maize production area.

An identification programme revealed that the so-called maize rootworm, which was found in the Piet Retief and Greytown areas, was the Rhodesian species *Buphonella maurina*. A further species of a false wireworm and a possible further species of a ground weevil were traced.

It was found in the course of a fertilising trial in the Eastern Cape on deep red soil with an annual rainfall of 1 100 mm that a dressing of 800 kg of urea per ha produced a yield of 8 tons of maize, as against 3 tons without nitrogen dressing.

During the past season the maize hybrids PNR 536, 353 and 542 again produced the highest yields in the coastal area and in the higher rainfall areas of the interior.

Preliminary results of a planting date trial showed that July/August is the best planting time for the coastal area as against September/October for the interior.

Maize stalk borer

Suggested preparations for the control of stalk borer (from the group known as synthetic pyrethroids) provided better protection against damage to heads than the preparations registered at present, which do not belong to this group.

Tractor spraying with these preparations, carried out as late as the 50 per cent tassel emergence stage, provided effective control of late infection and produced yields that were up to 120 per cent higher than the yields obtained with the conventional sprays.

Buckwheat

Two promising buckwheat cultivars were identified, but they will have to be tested for quality characteristics before release can be considered.

WINTER CEREALS

Breeding

The breeding and evaluation of several small grain species were continued by and under the supervision of the Small Grain Centre at Bethlehem and various Departmental and university bodies.

In developing new germ plasm researchers were able to draw on genetic material evaluated in the international nursery programme and obtained from the USA, Mexico, Hungary, Kenya, Algeria, Brazil, Ecuador, Canada and Rhodesia. The numbers of breeding strains of the various species evaluated are given in the table.

Bread wheat	17 nurseries	-	3 855 strains
Triticale	3 nurseries	-	1 149 strains
Barley	2 nurseries	-	3 376 strains
Durum wheat	4 nurseries	-	773 strains

The development of new winter, intermediate and spring wheats is progressing steadily and 764 new crossing combinations have been made, 33 952 segregating populations planted, 3 460 strains handled in preliminary evaluation trials, 1 087 strains planted in final trials and 106 strains included in élite trials. The breeding material was evaluated at 12 localities throughout South Africa.

The breeding programme owes a great deal to studies on pathology, grain technology and entomology. This co-operation ensures that, in addition to producing good yields and being well adapted, the newly developed strains will have high resistance to disease and be of good quality.

The advantages of triticale wheat in certain harsh environmental conditions such as drought and low soil pH were again demonstrated this year. Triticale breeding strains which were tested throughout South Africa against commercial bread wheats produced significantly higher yields and also showed evidence of higher tolerance to acid soils. The utilisation of triticale for grazing in the Highveld Region and as a kernel feed in the Western Cape is being investigated.

Plant protection

With regard to air-borne diseases, attempts to obtain new genes with resistance to stem rust, leaf rust and *Septoria* are continuing. In order to monitor the stem rust spectrum in South Africa from year to year, trial plantings that included the most important strains and cultivars were planted in several localities. This data, together with the samples received from commercial plantings, gives one an early indication of any change in the stem rust spectrum.

With regard to root diseases, research on crater disease is progressing steadily on the Springbok Flats and several other root pathogens are being studied in the rest of South Africa. The pathogenic organism that causes crater disease was identified as *Periconia macrospinosa,* whose action is probably associated with toxin formation. *Gaeumanomyces graminis* was identified as the main problem in other areas.

Wheat production in large areas of the OFS was badly affected this year by the incidence of a new plant aphid, *Diuraphis noxius,* which was reported south of the Sahara for the first time. This aphid is probably the vector of a new disease in the OFS, and the pathology department of the university agreed to research the problem. Cultivars with resistance to the aphid were obtained from the USA and are at present being bred into existing cultivar material.

Quality

The Grain Technology Section was established this year and carried out the following tests on breeding strains:

Seed colour	7 306 strains
Pearling index	3 960 strains
Quadrumat extraction	3 545 strains
Udy protein	3 495 strains
Mixogram test	3 545 strains
Pelshenke test	2 805 strains

These screening parameters make a considerable contribution to the more meaningful evaluation of progressing breeding material.

Datametrics

The datametrics work team of the Small Grain Centre contributed a great deal to the rapid processing and evaluation of experimental material. The purchase and linking up of two H.P. 9815 computers to digital scales has reduced the time required to carry out mass measurements and analyse trials from two months to two hours per trial of 49 entries with four repetitions.

Liaison abroad

As in the past, liaison abroad was furthered by the SARWEIN programme, which included several South American countries this year, in addition to Botswana, Lesotho, Malawi, Mozambique, Rhodesia and Swaziland. Local material was also included in overseas nurseries and one breeding strain, W 107 (Timgalen/Inia/Bajio), showed the fifth highest resistance to stem rust out of 760 entries, at 37 test localities throughout the world.

All these inputs culminated this year in the release of three new wheat cultivars, one oats, one durum and one barley cultivar; a further two wheat strains and one barley strain were provisionally released.

The real impact of the breeding programme will only become apparent at a later stage, but a number of strains are already showing great promise.

Cultivar evaluation

Wheat

Adaptation trials with wheat were considerably expanded in the summer rainfall area - to 60 and 32 on dry land and under irrigation, respectively. In the winter rainfall area the number of trials was also increased, namely to 35, but owing to the drought it was impossible to harvest a number of trials.

At the same time the élite trials, which include the most promising strains, were increased to 20 on dry land in the Free State. Five élite trials were planted on the Springbok Flats and five were planted under irrigation. Ten élite trials were conducted in the winter rainfall area. This research enabled the Small Grain Centre to take the following action:

- The cultivar Flamink (XMS52) was finally released as a Class A wheat. It has a stable yield potential, good baking quality, is resistant to rust, has strong straw and excellent hectolitre mass. This cultivar is recommended as an intermediate type in the Eastern Free State.
- The cultivar Zaragoza 75 (Meng 8156) was finally released as a Class B under irrigation. This cultivar has a good yield potential, is resistant to rust, has a strong straw and fits in well in the various irrigation areas.
- The two wheat strains T76/51 and S72/485 were submitted and both were accepted for release in 1980 for the Free State and the Springbok Flats respectively. Both strains had a better yield than the standard, good baking quality, excellent resistance to rust, and other acceptable agronomic properties. The Small Grain Centre intends to multiply foundation seed this year so that the two new cultivars will be available for commercial planting by 1980. The two strains will be released under the names of Wilge and Palala.

Oats

Élite trials were carried out at Bethlehem and in the Winter Rainfall Region with the object of evaluating new strains for release to the industry. The new cultivar Swartberg was released and the strain Tam-O-301 is showing considerable promise.

Barley

Barley élite trials were carried out at Bethlehem and Vaalharts and at six localities in the Winter Rainfall Region. It is interesting that strains that showed good agronomic properties in the Winter Rainfall Region showed similar properties in the Free State. The barley strain B 73/1 was accepted for release in 1980 under the name of Loerie and seed is being multiplied this year. Two promising barley strains, namely B 75/1 and B 75/4 are being multiplied at Caledon under the supervision of the Wheat Board for macro quality tests. Another very important barley strain, B 76/3, is being multiplied at Departmental research stations this year for macro quality analysis in the near future. In addition to the above, the programme includes other very promising strains. The élite trial under irrigation at Vaalharts was very successful and the strain Diamant was accepted for release in 1980. In terms of quality and other agronomic properties it is an outstanding barley variety. According to a planting density trial under irrigation it appears that the optimum planting density for Diamant is 75 kg/ha, the planting time being around 15 June. The same density can be applied in the Rûens.

Durum

Yields of 6 to 8 tons of grain were obtained in the Fish River Valley: Nitrogen fertilising appears to be a critical production factor, with regard to quality as well as yield.

Weed control

Weed control was expanded considerably. There are indications both in the field trials and in the trials under controlled conditions that spraying should preferably take place at slightly longer intervals between the growth stages 6 and 9 than under the present norms.

The determination of the successive growing point stages of two- and six-row barley is virtually complete and preliminary research on spraying stages for barley is far advanced.

Plant feeding

Since there are still virtually no fertilising standards for the summer rainfall area, the NPK trials were extended to seven winter trials, three intermediate and two spring trials in the Free State, and three trials on the Springbok Flats. Three trials were carried out under irrigation in various soil-climatic situations so that a better picture of the fertilising requirements of wheat could be formed. Varying responses were obtained but nevertheless a fairly clear trend emerged. Winter plantings in the western parts of the OFS require very little nitrogen, if any, plantings in the central areas require about 6 to 10 kg of N/ha and those in the eastern parts about 10 to 15 kg of N/ha. For intermediate plantings, which are found chiefly in the higher rainfall areas, on moisture-retentive soils, 14 to 24 kg of N/ha is recommended. Twenty-five to 40 kg of N/ha is recommended for spring plantings. Phosphorus and potassium are applied on the basis of yield potential and soil analyses.

In the winter rainfall areas the optimum levels of N fertilising are from 45 to 55 kg/ha.

Under irrigation, especially, there was a better response at lower nitrogen levels than at the traditionally recommended level of 120 kg of N/ha. Sufficient potassium is generally present in irrigated soils and the emphasis falls mainly on interaction between N, P and K in terms of grain yield and baking quality.

Nitrogen fertilising trials with barley under irrigation at Vaalharts with a view to quality have already shown strong indications that even with 120 kg of N/ha the nitrogen content of the seed is acceptable for brewing purposes. The nitrogen content of barley is a critical parameter for quality.

Physiological studies

Considerable progress has been made with physiological studies. A series of wheat cultivars were classified for day length and cold requirements. For example, the cultivar Belinda has the highest cold requirement, and Betta and Scheepers 69 respond favourably to day length. Yields in the Free State can be stabilised to a greater extent if the flowering period coincides with a 12,5 hour day length and this also coincides with the start of the rainy season.

Research has been carried out on sprouting, which is a major problem in the summer rainfall area. This is an enzyme-linked phenomenon and cultivar differences occur. Work on perfecting a fast, practical test for eliminating susceptible strains in time is proceeding. Progress has already been made with the classification of cultivars/strains according to alpha amylase content.

It has been found in the winter rainfall area that an optimum flowering period is correlated with optimum yields. For the Swartland the optimum flowering period is the first week of September and for the Rûens the second week of September.

Foundation seed supply

The Small Grain Centre supplied 20,5 tons of foundation seed of 13 wheat cultivars and one durum cultivar to the industry. 8,9 tons of foundation oats seed of seven cultivars was also supplied to the industry.

Soil cultivation (Winter Rainfall Area) for wheat

1. Langgewens Research Station

The past season was abnormal, but results were nevertheless obtained from the wheat monoculture and the wheat-fallow rotational cropping systems. The system in which wheat is sown on a medic pasture could not be applied, owing to drought.

(a) Wheat monoculture system

- The highest yields were obtained on those plots that were ploughed with a subsoiler during April and seeded with a one-way.
- The highest average yield, calculated over three years, was obtained where a disc plough was used for the initial cultivation and seeding was carried out by means of a one-way.
- Data show that the nitrate N and the total N in the soil at seeding time were highest where tined implements had been used for cultivation or where soil cultivation was applied only at seeding time. This trend was also evident in respect of the oxidisable carbon in the soil.
- The system of growing wheat without any seedbed preparation produces very poor results when applied under very dry conditions.

(b) Wheat/fallow rotational cropping system

- As in 1976, the mouldboard proved to be the most effective implement for fallow cultivation.
- Unlike in 1976, the best results in 1978 were obtained by using the Fieldspan for soil cultivation during the summer.
- The one-way still appears to be the best implement for sowing, judging by yields.
- The level of soil nitrates immediately before seeding time was highest on the plots where a mouldboard or disc plough was used.

- In a dry year a wheat/fallow rotational cropping system has decided advantages over a system where wheat is grown on the same soil every year.

2. Tygerhoek Research Station

(a) Wheat after four years of rotational cropping with lucerne

- The highest grain yields were again obtained from the treatments in which only tined implements were used.
- The plots where no seedbed preparation was applied in advance again produced the lowest yields. However, these plots produced the most pasture (lucerne) during the summer months.

(b) Lucerne regeneration trial

This trial consisted of an investigation into the effect of a cultivation and/or a topdressing with phosphates on the production of an old lucerne land. The following preliminary results were obtained:

- If the lucerne stand in a lucerne pasture is still very dense, production is not improved by a soil cultivation. On the contrary, production may actually be reduced.
- Only a slight increase in production is obtained by applying a phosphate topdressing (300 kg of superphosphate/ha) to the lucerne pasture at the time of the cultivation.

These cultivation trials provided very valuable information which will be used in determining standards for the cost of cultivation methods in the present fuel situation. The data could also result in structural changes in cultural practices.

OILSEEDS AND PROTEIN-RICH SEEDS

GROUNDNUTS

Fourteen new crossings were made in the groundnut breeding programme at Potchefstroom. The programme is being carried out under irrigation and on dry land. A large number of single plant selections were made - 1 900 under dry land conditions and 3 500 under irrigation. Advanced breeding strains were evaluated in nine field trials. About 100 kg of breeders' seed of the new cultivar Sellie was produced.

The cultivar evaluation programme was expanded and 37 trials were planted. Yields of up to 7,5 tons of kernels per ha were obtained under irrigation. Very valuable information on the control of leaf diseases of groundnuts was obtained and a number of new preparations were tested.

SUNFLOWERS

In the course of the research programme on the microelement requirements of sunflowers at the Dundee Research Station, molybdenum deficiency symptoms were identified on sunflowers and the necessary supplements to relieve the deficiencies were determined. It was found in the course of an intensive research programme that sunflower cultivars differ considerably in respect of their ability to take up microelements from the soil. Differences in respect of boron uptake were particularly marked. Critical boron concentration levels in sunflower leaves were determined.

During the past season over 250 inbred strains were evaluated for compatibility in trials conducted at Potchefstroom and at the Nooitgedacht Research Station (Ermelo). Thirty-five experimental hybrids were retained from this experimental programme and will undergo further evaluation.

A very high level of infection with the white rust fungus *Albugo tragopogonis* was observed on breeding material at Potchefstroom. As a result it was possible to identify a number of strains that have very good resistance.

Field trials in which all commercially available and new sunflower cultivars were tested were carried out in all the most important sunflower areas of the country. An average seed yield of 2 095 kg/ha was obtained from 30 trials conducted in all the major production areas. The high yields obtained during a season that was generally regarded as a very poor one are a good indication of the exceptional adaptability of properly tended sunflowers.

DRY BEANS

Trials with dry bean cultivars were conducted at 10 different localities in the country. On the basis of the results obtained in these trials, a small white dry bean cultivar, Teebus, that had been bred by the Department, was released to the industry. Disease-free seed will be made available during the 1979/80 season.

SOYA BEANS

A very successful cultivar evaluation programme was completed during the past season. All the commercially available cultivars and a series of new strains and introductions were planted in the course of the trials in all the most important production areas. Yields of up to 4 tons per ha were obtained.

POTATOES

Breeding and selection

In several areas the Department's national breeding strain evaluation programme produced breeding strains that had performed better than the standard cultivars during the past few years. At present these strains are being multiplied by the Department and by selected seed potato growers in the areas where they were selected.

The development of new strains from the breeding programme made organised cultivar trials in the most important production areas necessary.

These cultivar trials are being conducted at 12 localities at present.

The new cultivar Baku, which was released to seed potato growers last season, is being multiplied and evaluated on an extensive scale. Astrid, another very promising new cultivar, is also being multiplied and intensively tested in cultivar trials at present.

Cultivation and fertilising

The results of a sprouting stimulation trial at Ermelo showed that gibberellic acid, particularly, and a volatile mixture called Rindite, are very successful in stimulating further sprouting in poorly sprouted potatoes.

Farmers are increasingly concerned with following a more realistic fertilising programme in view of shrinking profit margins, the possibility of drought, demonstrations and lectures over a long period and their experiences on their own farms. This applies to potassium fertilising in particular, but also to nitrogen fertilising. A tuber size x espacement trial at the Nooitgedacht Research Station provided further evidence that the critical factor is the number of culms in a particular area, and this is determined by both the espacement of the seed potatoes and their size.

Investigations at Cedara into the effect of high levels of nitrogen and its time of application on potato tuber yield and quality have revealed that for a spring planting (short day-length conditions) high levels of nitrogen applied at planting do not delay tuber initiation or adversely affect tuber yield and quality.

If, however, planting is delayed until the period between October and February the long-day conditions at that time of year, together with high levels of nitrogen, are responsible for delayed tuber initiation and reduced tuber yield and tuber quality.

Moisture stress is one of the main factors limiting both the yield and the processing quality of the potato crop. A potato research project is being carried out at Cedara, in collaboration with the potato work team, to investigate the effect of moisture stress at four different stages of growth on yield and quality.

Results to date indicate that moisture stress during the early stages of growth has only a slight depressive effect on yield but seriously affects tuber processing quality and scab infection. On the other hand, stress during the latter half of the tuber bulking period causes severe yield reduction, but does not affect tuber quality adversely.

Aphids

Research on the migratory habits of the green peach aphid was continued on the Transvaal Highveld when 15 yellow traps were put out. These surveys took place on a weekly basis from September 1978 to February 1979.

The information gathered on the Transvaal Highveld over the past three years indicates that the aphids migrate actively in this production area, mainly from the middle of November to the end of January. This information is of great practical importance in the control of virus vectors.

Snout beetles

The snout beetle responsible for the increasing damage to potato tubers in the Eastern Free State was identified as *Sciobius horni*. Whereas the adult black maize beetles do the most damage, it is the larvae of the snout beetles which are the destructive stage.

Measures to control this pest are being studied.

Black maize beetle

Intensive research is being devoted to measures to control this important insect pest, but so far no practical control measures have been found. The incidence of this insect pest is increasing all the time on the Highveld and there are already areas on the farms of some producers where the damage is up to 50 %.

Plant diseases

The cultivar 890/20 has been successfully purified of potato virus S and the selection H 11 has also been purified of a mixture of virus X and virus S. It was found that in the case of 890/20 no fewer than 600 meristem cultures were necessary to obtain six virus-free plants.

The cultivars Elsa, 890/20, Astrid, Baku and the selctions H 11 and H 18 have so far been purified of viruses.

Bacterial diseases

In 1978 bacterial wilt (caused by *Pseudomonas solanacearum*), which is considered endemic in the warmer eastern part of South Africa, again occurred in seed potato plantings after many years' absence.

After intensive investigation the origin of the infection was traced back to a single source. No susceptible crop has been planted in the infected field for 20 years and the manner of survival - on weed hosts or in the subsoil - at the low winter temperatures and soil moisture levels prevailing there is being investigated.

It would appear that the strict inspection and quarantine measures introduced are successful in controlling and probably eliminating bacterial wilt in the seed potato industry.

Weed control

The results of trials and surveys indicate that the reported cases of damage following the use of metribusin have as their basis adverse factors such as drought, infection etc. Further investigation of the part played by the adverse factors is required to limit further damage in practice.

Cytogenetic study of *Opuntia aurantiaca*

The biggest penetration of *O. aurantiaca* took place in the Eastern Cape, where the most problems were experienced. It was recently established by means of cytogenetic studies that this South African invader plant consists of a single biotype imported from the Argentine. *O. aurantiaca* formed a complex in the Argentine which consisted of hundreds of biotypes. The plant which has infested the Eastern Cape appears to be the vegetative progeny of a single plant or a number of identical plants imported into the Republic.

COTTON

Breeding

The cultivar Alma, which was bred by the Department, was registered during the past season. Alma was developed from the Albar x North Caroline Marging cross and is especially noted for its good yields under all weather conditions.

The use of a growth inhibitor on some of the F_7 progeny not only restricted the growth of the plants, but also produced higher yields, whereas the quality remained the same.

During the past season full-scale use was made of the new pyrethroid insecticides for the first time, together with ordinary insecticides. Very successful control was obtained in this way.

SISAL

The culmination of 12 years' research on sisal at Hluhluwe, Zululand, has shown that high populations, viz 6 000 plants/ha, produced a highly significant 3,7 tons/ha increase in dry fibre yield compared with populations of 4 000 plants/ha. Valued at R530/ton, this represents a net increase of R1 950/ha over 10 years.

Applications of 160 kg/ha of N produced a 3 tons/ha increase in the dry fibre yield. The combined response of high plant densities receiving nitrogen was 7,1 tons/ha. Taking fertiliser costs into account, this represents an increase of R2 900/ha over 10 years in gross returns.

In view of the current energy crisis and the renewed importance of natural fibres, these findings should be of great significance to the sisal industry.

TOBACCO

The tobacco breeding programme is progressing very well. The programme is aimed at providing high-yielding flue-cured, dark air-cured, light air-cured, Burley and Oriental tobacco cultivars capable of producing good quality tobacco and resisting diseases and pests at the same time.

Kromnek has been causing major losses in some production areas for some time and a programme aimed at breeding resistant cultivars of various classes of tobacco has been launched.

Flue-cured tobacco

The breeding strain TL33/3, which is resistant to various races of the black shank fungus *Phytophthora nicotianae* B. de Haan var. *nicotianae* appeared promising in cultivar trials and is now available for cultivation.

The cultivar B61 was released for cultivation. Like TL33/3, B61 is resistant to the tobacco mosaic virus (TMV), powdery mildew *Erisyphe cichoracearum* DC and the black shank fungus, and it has satisfactory agronomic properties.

Air-cured tobacco

A selection from the breeding strain CL8, namely 78H5, is resistant to powdery mildew, TMV and black shank. It also possesses the properties of the well-known Groot Swasie cultivar and seed has been supplied to selected producers for cultivation.

Burley tobacco

Seed of the cultivar 77CB17, which is resistant to powdery mildew, TMV and black shank, has been released for cultivation. The American cultivar B64 is also grown, on a limited scale.

Oriental tobacco

Several high-yielding breeding strains which are resistant to TMV and powdery mildew have been tested in the Western Cape cultivation areas. A few qualify for release.

Planting methods

Flue-cured tobacco

Densely spaced, deep-topped plants yielded about 640 000 leaves/ha and produced a considerably higher yield and income than tobacco grown by the conventional procedure. It was possible to manipulate the levels of the important leaf component nicotine successfully through the judicious use of cultivars, plant espacement, topping depths and fertilising with nitrogenous fertiliser.

Light air-cured tobacco

It has been found that dense espacement and deep topping of plants yielding 480 000 to 560 000 leaves/ha result in good leaf development, production and quality. The results confirm those of previous seasons.

Dark air-cured tobacco

In low-profile trials in which the plant population was considerably increased and the number of leaves per plant reduced, large dark leaves were produced and the yield was boosted considerably.

Tobacco plants in the phytotron at the Tobacco Research Institute

Burley tobacco

Very promising results were again obtained with denser espacement and deep topping of plants, which virtually amounts to a low-profile production method. This method not only produced high yields and good quality tobacco, but leaf losses (which are generally high with whole-plant harvesting) were low and all the leaves on the plant ripened evenly.

Oriental tobacco

Oriental tobacco is a very labour-intensive enterprise, largely because numerous leaf pickings are necessary. It has been found that whole-plant harvesting reduces the yield considerably and that this reduction in the yield can be eliminated by partial leaf harvesting. However, whole plants were harvested with a considerable increase in the yield after they had been densely spaced and topped to a limited number of leaves per plant. The mechanisation of planting, topping and harvesting is being considered.

Mechanised planting and harvesting

Mechanised harvesting of tobacco leaves

Two semi-automatic harvesters were compared with each other and with conventional manual harvesting. The three methods showed no significant differences in the harvesting period, but the saving on man-hours/ha of tobacco harvested was reduced by more than half where tobacco was harvested by means of the semi-automatic harvesters.

Cultural practices

Induced ripening

Control over the ripening of his crop will enable the tobacco farmer to make more efficient use of his expensive curing facilities. Controlled ripening could also save fuel and help to avoid leaf spot diseases.

The ripener Ethrel is only effective on adult leaves under conditions favourable to ripening. During the current season the administration of Ethrel not only accelerated ripening considerably, but also resulted in a significantly higher price for and income from flue-cured tobacco.

Irrigation

The water requirements of tobacco have already been established at about 600 mm per season. Water applications were reduced by a further 150 mm by irrigating only during critical stages, and no drop in production resulted. Pumping costs were reduced by withholding irrigation during the first 4-6 weeks after planting, without any reduction in the yield.

Rotation of wheat and tobacco

Tobacco is grown in most production areas in a rotational cropping system with wheat. Without any cultivation taking place after the harvesting of

the wheat, tobacco is planted in furrows and on banks. It was found that tobacco (monoculture) produced higher yields than tobacco grown in a rotational cropping system with wheat. However, the income obtained from the wheat compensated for the lower tobacco crop, with the result that a wheat/tobacco rotational cropping system produces a higher income than a tobacco monoculture system.

Diseases and pests

Black shank - *Phytophthora nicotianae* var. *nicotianae*

Although resistant tobacco cultivars are already available, there is a danger that the fungus may be able to overcome the resistance. Additional chemical control of the disease is therefore a valuable aid. Two effective chemical preparations, both of which produce excellent results on the land, were discovered during the past season. Residue trials have already been carried out with these preparations.

Black root rot - *Thielaviopsis basicola*

It has been found that recognised seed-bed fumigants reduce the fungus population in the soil, but cannot sterilise the soil completely.

At present the best fungicide for use against black root rot is benomyl. A new fungicide which was tested in the laboratory and the glasshouse proved to have an excellent fungicidal action.

Another race of *Thielaviopsis basicola* which attacks groundnuts but not tobacco was isolated.

Kromnek

White Burley is a general indicator plant for the identification of the kromnek virus. This cultivar is, however, susceptible to powdery mildew, TMV and many other tobacco diseases, which makes it difficult to describe the symptoms.

TL33 is a flue-cured cultivar which was developed locally, with a high resistance to powdery mildew, TMV and black shank. This cultivar appears to be a better indicator plant. Not one of the 25 tobacco cultivars screened for resistance to kromnek virus was resistant to this disease. The soil insecticide Curaterr appears very promising in the control of the disease.

Potato virus Y (PVY) and leaf curl

It has been found that the spraying of tobacco with systemic and contact insecticides once every two weeks reduces PVY infection only slightly, but largely eliminates leaf curl infection.

Nematodes

It has been shown that, with the exception of methyl bromide, no registered nematocide is able to control nematodes in the soil to such an extent that annual treatment can be eliminated. Temik is a new nematocide that has recently been registered for use on tobacco.

Cigarette beetle

Of the synthetic pyrethroids tested as residual preparations for the control of cigarette beetle, only a few preparations appeared promising. Natural pyrethrins are practically unobtainable, but the new synthetic pyrethroid, permethrin, appears to be an acceptable substitute and should be registered shortly.

Residues

The specific sugar:nicotine ratio in tobacco is an important quality characteristic. The addition of molasses to certain insecticides increased their efficacy without impairing the quality of the tobacco.

During the past year an increasing number of complaints about registered insecticides have been received. Trials demonstrated, however, that phytotoxicity or abnormal growth of tobacco were only produced when the preparations in question were incorrectly used.

Curing

Utilisation of solar energy

Preliminary work showed that, by using the present roof area, which is painted black and then covered with transparent fibreglass panels to form an air channel which serves as a preheater, an efficiency of 45 % can be achieved on an average summer's day. Further investigation is required, however. At current prices the inclusion of solar heaters in coal-burners is not economically justified. In the case of diesel units it would be preferable to convert to coal rather than to include solar heating in the diesel units.

Central hot-water system for tobacco curing

The experimental development of a central hot-water system for heating two miniature tobacco curers was started. Satisfactory temperature control during the curing process was possible with a water temperature of 95 °C. A low pressure boiler can therefore be used for the central heating plant.

Fuel-saving in the bulk curer

Trials have shown that up to 28 % fuel (coal) per curing can be saved if the air damper of the coal boiler is correctly adjusted and the curing schedule recommended by the Institute is correctly and scrupulously followed.

Packing trial with flue-cured tobacco in the bulk curer

Fresh whole tobacco leaves and leaf fragments are packed in containers in various orientation

patterns and cured in the bulk curer. No significant differences in the quality of the tobacco were observed after curing. It appears to make no difference how the leaves are packed inside the container. An important requirement, however, is that the packing density of the leaves in each container of the curer should be even in order to keep air channelling through the tobacco to a minimum. These results will be of importance if mechanisation of the harvesting and packing of the bulk curers is to be fully developed in future.

Curing flue-cured tobacco in the bulk curer

Further investigations were carried out with the object of perfecting the recommended curing schedule for flue-cured tobacco. It was found that during hot, dry weather the leaf tips of the lower layer of tobacco in the curer are easily damaged at the beginning of the curing process, with a corresponding loss of quality. An investigation aimed at modifying the curing schedule in order to eliminate this problem was started. The curing schedule was also adapted in order to create more favourable conditions for breaking down the green pigments in the leaf more rapidly at the end of the colouring period.

Quality

Nicotine status of flue-cured tobacco

It was found that an increase in the nitrogen fertilising level from 60 to 90 kg of N/ha produced an increase of 13,7 % in the nicotine content of the tobacco. Early topping and an extended colouring period in the curer boosted the nicotine content by 9,0 % and 8,8 % respectively.

Reconstituted tobacco

The reconstitution of tobacco has little or no effect on its nitrogenous components. This is a major advantage, especially in respect of the nicotine content. The effect on colour, sugars and related components is considerable, however. The colour tends to become darker, and the sugar content drops. From the technological point of view the colour is not important. A reduction in the sugar content is desirable because it produces a better sugar:nicotine ratio.

Quality characteristics of the new grade marks for flue-cured tobacco

The results of physical and chemical analyses show that there are visible differences in the quality characteristics of the various grade marks. The sugar content and sugar:nicotine ratio, in particular, showed considerable differences. The results also show that the composition of tobacco grown in the various production areas differed significantly. Tobacco grown in the Lowveld had considerably more body than tobacco grown in the Potgietersrus and Rustenburg production areas. The nicotine content of the Lowveld tobacco was also considerably higher, and the chlorine content was lower.

Tobacco seed production

The Institute is the sole producer of tobacco seed in the Republic. True-to-type, viable seed of all the registered Virginia tobacco cultivars is multiplied at the Hartebeespoort Research Station near Brits; during the year 2 334 kg of tobacco seed was sold for commercial tobacco production, either direct to the farmer or through the various tobacco co-operatives.

Seed for the production of Oriental tobacco in the Western Cape is produced at Elsenburg under the direct control of the Institute.

Commodity extension

Farmers' days and study group meetings in the various tobacco production areas were addressed by officers of the Institute on 52 occasions. Various aspects of tobacco cultivation were discussed. These meetings were attended by 1 120 tobacco producers. Officers of the Institute also paid hundreds of visits to farms during the year under review to investigate problems and 840 farmers and other interested persons visited the Research Institute and its field stations.

HORTICULTURE

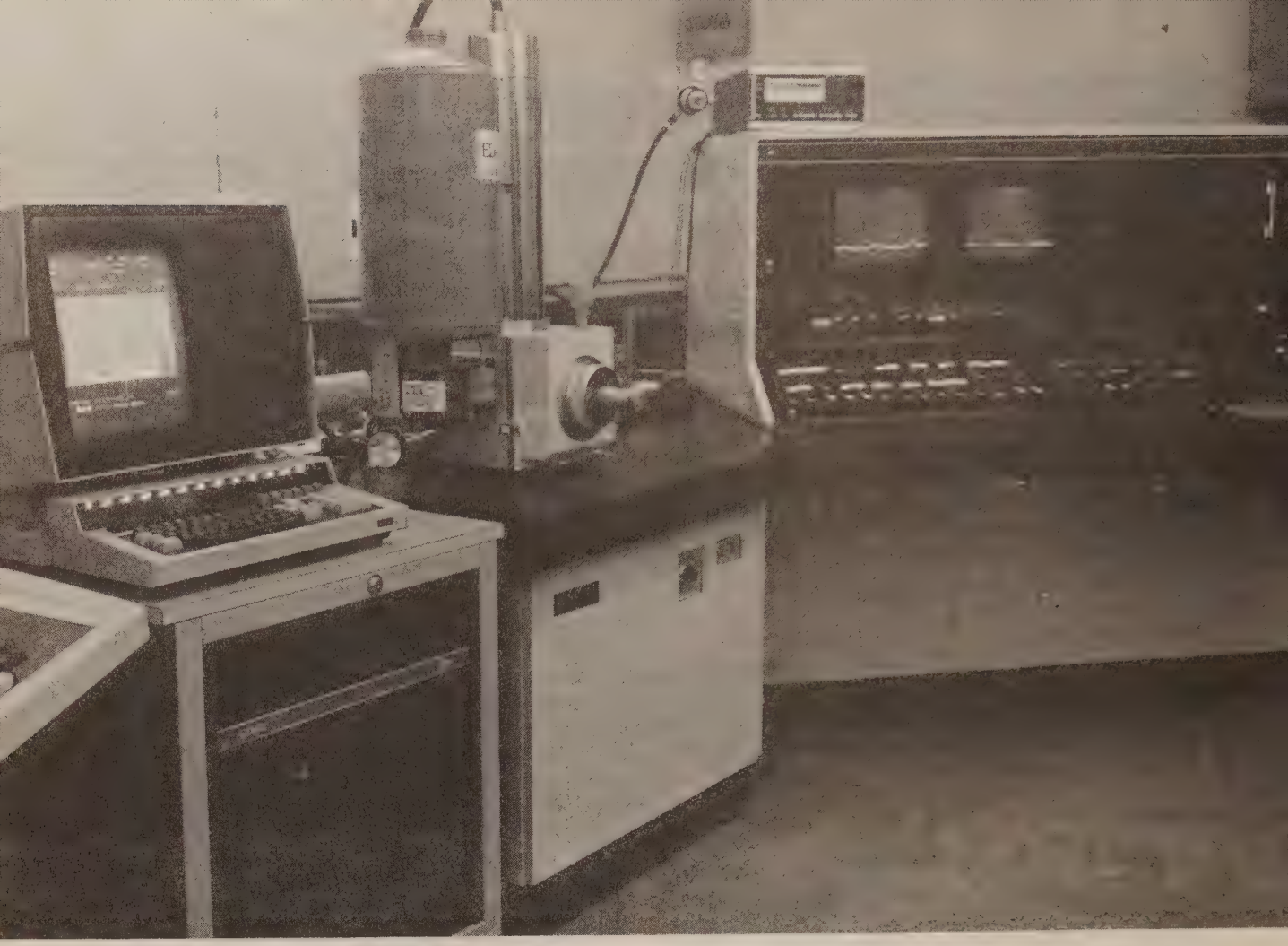
POMES AND DRUPES

Winter Rainfall Area

In 1979 the development of bitter pit in South African apples sold overseas was far more extensive than usual. The acquisition by the Fruit and Fruit Technology Research Institute of a scanning electron microscope, an instrument which can be used for the micro-analysis and microphotography of plant tissue, will lead to a better understanding of this disease and make an important contribution to the solution of the problem.

The good prices fetched by and the ready demand on the market for the new range of plums bred by the FFTRI became evident during the 1979 season. These plums have the further advantage of being very well adapted to local conditions and bear far larger crops than the imported plum cultivars which still account for part of the plum industry. The latter are steadily being replaced by the locally bred cultivars, as is demonstrated by the latest available planting figures, which indicate that more than 60 % of all plantings from 1974 to 1976 consisted of the first two locally released plum cultivars. Plantings have increased rapidly since the release of Reubennel, an early midseason plum, in 1977.

There is a strong preference for yellow-fleshed peaches over the white-fleshed varieties both overseas and locally, and a number of promising



A scanning electron microscope was taken into use by the Fruit and Fruit Technology Research Institute during the year under review. Among other things, it can be invaluable in the study of the bitter pit problem in apples

yellow-fleshed peaches and nectarines were imported by the FFTRI for evaluation under local conditions. Of these imports, five promising peach cultivars and five nectarines were released in 1978. One of the nectarine cultivars has already been placed on the export list.

New cultivars

As predicted, the plum selection 2/58 was released as a new late midseason cultivar; it was given the name of Redgold. Redgold is derived from a crossing between Golden King and Wickson. Owing to its general excellence and the fact that it ripens after Harry Pickstone and before Kelsey, it was decided to release it, despite the fact that it has not yet been evaluated in all areas.

The third pear rootstock released by the FFTRI is known as BP-3. BP-3 produces a stronger tree than BP-1 or BP-2, induces an early and heavy crop and produces trees of uniform size. Bright red and yellow autumn foliage is characteristic of BP-3, so that the plants make a striking show in autumn.

BP-3 has already been purified of viruses and handed over to the South African Plant Improvement Organisation for multiplication.

APPLES

Pest and disease control

A monitoring system for beetle predators of pest mites has been successfully developed. Coloured boards coated with gum are hung in apple trees. The beetles are attracted by the boards and trapped in the gum. The method is very effective, even at low beetle population levels.

Fusicladium (apple scab)

It has been established that the susceptibility of apples to fusicladium decreases as the age of the fruit increases. Longer wetting periods were required to produce infection in older fruit than in younger fruit. At the picking-ripe stage mancozeb provided protection for a far longer period than dodine.

PEARS

Breeding of improved cultivars

Scab (fusicladium) is a major threat to pears, and good progress has been made with the breeding of resistant cultivars. Almost 10 000 seedlings, obtained from three different combinations of parents, with Kieffer as the resistant parent, were infected with fusicladium spores.

Crisp apple snacks (similar to potato chips) could be an alternative market for apples

Relative resistance was found in 4 279 seedlings. A further crossing between Kieffer and Packham's Triumph yielded 9 968 seeds, which have already been stratified with a view to further evaluation.

PEACHES

Eleven imported yellow-fleshed dessert peaches were crossed with Selection 45/10, which has an excellent keeping quality. A total of 4 064 F_2 seedlings and 410 seedlings derived from crossings were planted. Of the selections tested for keeping quality, one kept well, four moderately well and 12 poorly. The drying quality of six selections was classified as excellent.

PLUMS

Breeding improved plum rootstocks

The five promising plum rootstocks reported on last season again made a good showing. In addition to these five, one semi-dwarfing selection was found that performed better than virus-free Marianna. Four of the rootstocks investigated were better than Marianna in respect of production efficiency and three (6-46, 8-6 and 9-52) had considerably greater dwarfing properties than Marianna. The last-named three are in fact semi-dwarfing stocks.

If they continue to perform satisfactorily, they will make very promising limited size rootstocks for high density plantings and more economic production.

In certain regions and on certain soils high density planting may not be practicable, and this investigation successfully identified another rootstock (12-55) which is as vigorous as Marianna, but has a better production efficiency.

Tight-fill packing of plums

Commercial tight-fill packing trials with five plum cultivars were undertaken for the local market during the past season. A telescopic cardboard container with a net fruit mass of 10 kg was used for this purpose. A wooden box with a net mass of 9,1 kg of unwrapped fruit was used as a control.

The tight-fill packed plums were significantly better throughout than the control, chiefly because of the elimination of abrasions, which is the biggest problem with the standard loose pack. As tight-fill packing becomes more widely used the quality of plums on the local market could improve considerably.

Shot-hole *(Xanthomonas pruni)*

During the 1978/79 season weather conditions were favourable to the development of shot-hole. Investigations carried out showed that almost 5% of the apparently healthy leaf and fruit buds on plum trees may be infected with this bacterium. Latent bud infection of this kind was at a peak during the period January to November.

Bud infection is largely responsible for the primary spread of the disease from nurseries to the farms of producers. Secondary spread of disease from tree to tree and from orchard to orchard is linked largely to rain, accompanied by wind.

It was found that from one to four cankers at the centre of a half hectare orchard are sufficient to infect the entire orchard within one season.

TABLE GRAPES

Breeding of improved cultivars

Good progress was made with the breeding of improved table grape cultivars: A provisional selection of seven seedlings was made for the evaluation of a late white cultivar, and four are at present undergoing final evaluation in Phase 3. Seven seedlings are undergoing evaluation for a new early black and/or white cultivar and one seedling was transferred to Phase 2 evaluation.

Irrigation

An investigation into irrigation scheduling, carried out on Waltham Cross with the aid of lysimeters, has been completed. The effect of various soil moisture levels on growth, yield and quality was studied over four growing seasons. The results showed that the water requirements of vines are relatively low, being an average of 226 mm per growing season. There was a positive correlation between water consumption and yield, with no decrease in yield at high consumption levels. Consumption factors were drawn up for practical application.

Disease control

Grey rot *Botrytis cinerea* is one of the most important of the vine diseases that affect the quality of table grapes. An investigation into the nature of the wintering sources of the disease revealed that vine prunings are one of the most important. Immediately after pruning 15% of the prunings were found to be infected with the disease. A gradual decrease in infection took place until March, when infection was under 1%. From March onwards the infection in the shoots increased gradually to about 4% in July. Trials with new contact fungicides against grey rot on Barlinka showed that two of the new preparations provide better control than the ones in use at present. The best preparation was Sumisclex.

FRUIT TECHNOLOGY

Ripeness of clingstone peaches

The investigation of the possibility of determining the ripeness of clingstone peaches with the aid of reflection measurement was continued. Fruit of two cultivars was divided into four ripeness groups on a visual basis; it was found to be possible to divide the fruit into further subgroups with the aid of whole fruit spectrophotometric readings. These subgroups were separately canned. The colour of the canned halves was very even.

Apple snacks

In order to create an alternative potential market for apples, the possibility of producing snacks, similar to potato crisps, was investigated. Apple snacks were prepared by drying pre-treated apple rings with various additives in two types of heating media at about 100 °C under reduced pressure, to produce a low moisture content. Two opinion polls on the products prepared in this way were conducted. Although no clear preference emerged for products prepared in either of the two types of heating media, there was a certain degree of preference for products prepared after pre-treatment with a certain additive.

Summer rainfall area

PEACHES

Effect of cultivars bred by the Department on the peach industry in the summer rainfall area

The first peach cultivar trial was planted 30 years ago at Roodeplaat. At that time, owing to a lack of suitable cultivars, it was impossible to realise the full production potential of peaches in the summer rainfall area.

The Horticultural Research Institute started a peach breeding programme in 1956 in order to breed cultivars with better resistance to certain diseases, particularly delayed budding, and a better fruit quality than the existing cultivars.

Before the Horticultural Research Institute was established, peach farmers had only dessert peaches such as Bell's November, C.O. Smith, Killiekrankie, Waldo, Early Dawn, Jubilee, Marina, Nooiens, Goldmine, Early Rivers, Babcock and Elberta in the most important peach-growing areas (especially around the Johannesburg-Krugersdorp complex) to plant. The first four cultivars also bore well on the Middleveld, where it is warmer, but the fruit quality and keeping quality of all these cultivars were poor.

The only yellow canning peaches planted were Keimoes and Kakamas.

No reliable data are available on the influence of cultivars bred by the Department on the peach industry in the summer rainfall area. If the number of peach trees (628 300) sold by three big nurseries in 1978 is taken as the criterion, it would appear that 95% of the trees planted last year were derived

from cultivars bred or selected in South Africa. The remaining 5% are trees of imported cultivars planted almost exclusively in domestic gardens.

One of the biggest peach nurseymen was seldom able to sell more than 100 000 trees a year, but since the new cultivars were released he has been selling over 400 000 trees annually. Of all the dessert peaches sold, Orion was in the greatest demand (22%) and of the canning types Oom Sarel (32%) was most popular, followed by Kakamas (22%).

Cold resistance of new cultivars for the Eastern Free State

Late frost did considerable damage in the Eastern Free State last winter. Nevertheless the two cultivars Clocolan and Imperani, which were specifically bred for the Eastern Free State, produced 70% (43 kg/tree) and 75% (69 kg/tree), respectively, of the normal crop.

The only cultivar that suffered no damage from the late cold was Kok's Late, which flowers very late.

Breeding and selection

In all 2 081 seedlings were evaluated during the year, 132 of which were selected for further evaluation.

The first group of F_1 and F_2 seedlings of which the parent was a nectarine should start bearing this year. About 3 800 new seedlings were transplanted last August and these seedlings should bear their first crop in 1981.

Adaptation of imported cultivars

Forty peach cultivars, imported from America and Australia, are being evaluated at Roodeplaat. Most of the cultivars have high cold requirements (750 hours below 7 °C) and consequently were poorly adapted at Roodeplaat. The only cultivars that are well adapted so far are Armgold, Armred, Armking, Desertgold, Sunlite, Sungold, Sunred, Sunrich, Springold and Springcrest. Most of the cultivars came from Gainesville in Florida (USA), where the winter climate is very similar to that of Roodeplaat.

APRICOTS

During the past two years 1 120 apricot seedlings were evaluated. No seedling or cultivar with resistance to cracking could be found. Over 10 cultivars were imported from Canada, Japan and India, chiefly to improve fruit size and resistance to cracking.

A new breeding programme was drawn up to make use of the imported cultivars.

CHERRIES

Farmers have shown less interest in establishing larger plantings of cherry trees. The chief reason is that cherries come into bearing very late (six years after planting) and the adult trees bear very irregularly. In addition, bacterial canker *Pseudomonas morsprunorum* is responsible for tree losses, especially in the case of young plantings. Consequently no significant expansion in the cherry industry is expected, although the demand for cherries on produce markets and at factories, especially, remains very keen.

Rootstock trials

Owing to cold damage no crop was obtained. It has been established that the rootstocks Mahaleb B47 and Mahaleb B40B are extremely susceptible to root rot under moist soil conditions; four years after planting 85 per cent of the cherry trees that had these two Mahaleb clones as the rootstock were either dead or had deteriorated to such an extent that all the trees in the trial on these two rootstocks had to be taken out. The rootstocks Mahaleb B40, Stockton, Morello, Mazzard F12/1 and the Mazzard hybrid Fb 2/58/48 appear to have a high resistance to temporarily waterlogged soil.

Propagation studies

Propagation studies with cherry rootstocks have reached an advanced stage. The most important rootstocks, namely Mahaleb B40 and Fb 2/58/48 root well when treated with 1 000 ppm of indolebutric acid, and between 60 and 85% buddable trees are obtained. Studies to determine the most suitable planting time indicate that the best rooting of cuttings is obtained when Mahaleb B40 is planted in May and July and Fb 2/58/48 in May.

Mazzard hybrid clones, which are regarded as the most important of the new cherry rootstocks, were found to be very susceptible to crown gall *Agrobacterium tumefaciens*.

TABLE GRAPES (SUMMER RAINFALL AREA)

As was mentioned in last year's report, producers are interested in planting table grapes in the Warmbaths, Nylstroom and Thabazimbi areas. Farmers have started a society for multiplying their own plant material and plan to supply about 100 000 grafted and rooted rootstocks to members in 1980.

Pirobella and Bien Donné, the cultivars bred by the Department, which are both early and resistant to cracking, should do very well in this area.

Breeding

The promising early, black grape selection BAR/Q 69-699 did very well for the fifth successive year. The berries again showed resistance to cracking. A month after ripening only 1% of the berries had cracked, as against 79% in Alphonse Lavallée. This grape ripens about two weeks before

Dan Ben Hanna but bears far later and is far more resistant to cracking. The Department intends to release the breeding strain as a new cultivar under the name of Ronelle and has also applied for plant breeders' rights for the new cultivar. Ronelle is released only for planting in the summer rainfall area.

Another breeding strain the Department is considering releasing is N47. This grape has exceptionally large berries, and the bunches are loose and require virtually no thinning. The grape has a rosy colour and ripens around the middle of February. The breeding strain is particularly well adapted in the Barkley West area and is released chiefly for cultivation in that area. The proposed name of the breeding strain is Rosete.

The first seedlings budded on Jacquez rootstocks in 1976 came into bearing this year. It will probably be possible to evaluate larger numbers this year. In all 1 954 seedlings were topworked onto Jacquez rootstocks during the past year.

PECAN NUTS

Evaluation in the Transvaal Middleveld and Highveld

In 1979, 1 645 kg of pecan nuts was harvested from one hectare at Roodeplaat. This yield was 117 % higher than in 1977 and 7,3 % higher than in 1978. This is the result of a modified fertilising programme, where the nitrogen level, in particular, is higher.

A general pamphlet on pecan nut growing was compiled at the request of producers.

The five cultivars recommended for the Transvaal Middleveld and Highveld are: Moore, Mahan, Barton, Success and Ukulinga. Ukulinga is a cultivar which was selected in the Republic. It bears from the fifth year and although only eight years old at present, it produced 27 kg per tree this year. The imported cultivars do not bear on the Highveld before 8 to 10 years.

OENOLOGY AND VITICULTURE

In order to ensure that the Institute's research programme in the various areas is closely geared to actual problems in those areas, experimental farm liaison committees were appointed in the main cultivation areas so that specific local problems could be discussed.

The virus purification programme for wine grapes and rootstocks is progressing favourably. Over 70 ha of rootstock parent clones has already been laid out and it was possible to make the first material under the S.A. Super Plant Scheme available to nurserymen this year. The first heat-treated material of eight scion cultivars has also been handed over to the multiplication organisation. This material performed so well that about 100 000 buds are available for oculating this year for the establishment of scion parent blocks. From the performance of the first heat-treated scions and rootstock there is every indication that this material will be one of the biggest single factors in boosting unit production in the South African viticultural industry.

Cultivar evaluation

Scion cultivars:

First phase: Experimental wines were made from 80 white wine and 30 red wine cultivars and crossings.

During the past year the following cultivars were promising with regard to the time of ripening, yield, resistance to rotting and wine quality: Lagrein, Huxelrebe, Schönburger and Ehrenfelser.

Scion cultivars

Second phase: In 1978 new interplanting trials were planted on the farms of collaborators at Villiersdorp, Hermanus, Douglas and Jacobsdal. There are now 32 trials of this kind in which both standard and new cultivars are being evaluated. New second-phase trials were also planted at Robertson and Lutzville.

In 1978/79 experimental wines were made from eight red wine cultivars from eight different co-operative interplanting trials, and from 10 white wine cultivars from eight interplanting trials.

Rootstock cultivars

In a trial on a deep sandy Hutton soil at Lutzville along the Olifants River, 13 rootstock cultivars are being evaluated with Chenin blanc as the scion. Yield data have already been assembled over five seasons and the highest yields to date were obtained in 1978. The rootstocks that performed the best were Metallica (36,3 tons/ha), 101-14 Mgt (32,7 tons/ha), De Waal (30,8 tons/ha), 110R (30,6 tons/ha), Salt Creek (29,9 tons/ha), 99R (29,1 tons/ha) and Rupestris du Lot (28,1 tons/ha).

Ten rootstock cultivars are being evaluated with Chenin blanc as the scion on a heavy silty soil at Vredendal along the Olifants River. Yield data for seven years have already been assembled and in 1978 the following did best: 101-14 Mgt (49,7 tons/ha), 143B (46,3 tons/ha), Salt Creek (46,2 tons/ha), 99R (45,0 tons/ha), Metallica (44,0 tons/ha) and 110R (43,8 tons/ha). Jacquez (22,4 tons/ha) was the only rootstock that produced a really poor yield.

Virus purification of wine and raisin grapes

Rootstock cultivars

The following wine grape cultivars were declared free of harmful viruses, subjected to ampelographic control and handed over to the Wine Grape Multiplication Organisation in 1978 for multiplication and distribution to the industry: Steen (3 clones), Cabernet Sauvignon, Cinsaut noir (2 clones), Pinotage, Sémillon, St. Emilion, Colombar, Clairette blanche, Cinsaut blanc,

Palomino fino, Riesling, Weisser Riesling 239, Gamay noir and Grenache blanc. The cultivars Muscat d'Alexandrie and Tinta Barocca have already been included in the foundation source and are ready for handing over to the multiplication organisation.

The raisin grape cultivars Korente and Sultana were also handed over to the South African Plant Improvement Organisation (SAPIO) in 1978 for multiplication and distribution to the industry.

Rootstock cultivars

After the handing over in 1978 of vineyard-tested 110R to the multiplication organisation for multiplication and distribution, virus-free material of all the currently important commercial rootstocks, namely 99R, 110R, 101-14 Mgt, 143 B, Jacquez and Salt Creek, should be available to the industry. Virus-tested material of the new rootstock 1103 P, which was released in 1976, is also being multiplied by the multiplication organisation.

The following new rootstocks have been purified of viruses and included in the foundation source of the Plant Protection Research Institute: Couderc 161/49, Berlandieri 13/5, Paulsen 755, S04 and Castel 216/3.

Almost 75 ha of parent blocks of heat-treated rootstock material have already been established and the first winter canes should be available to producers shortly.

Evaluation of quality of raisin grape cultivars

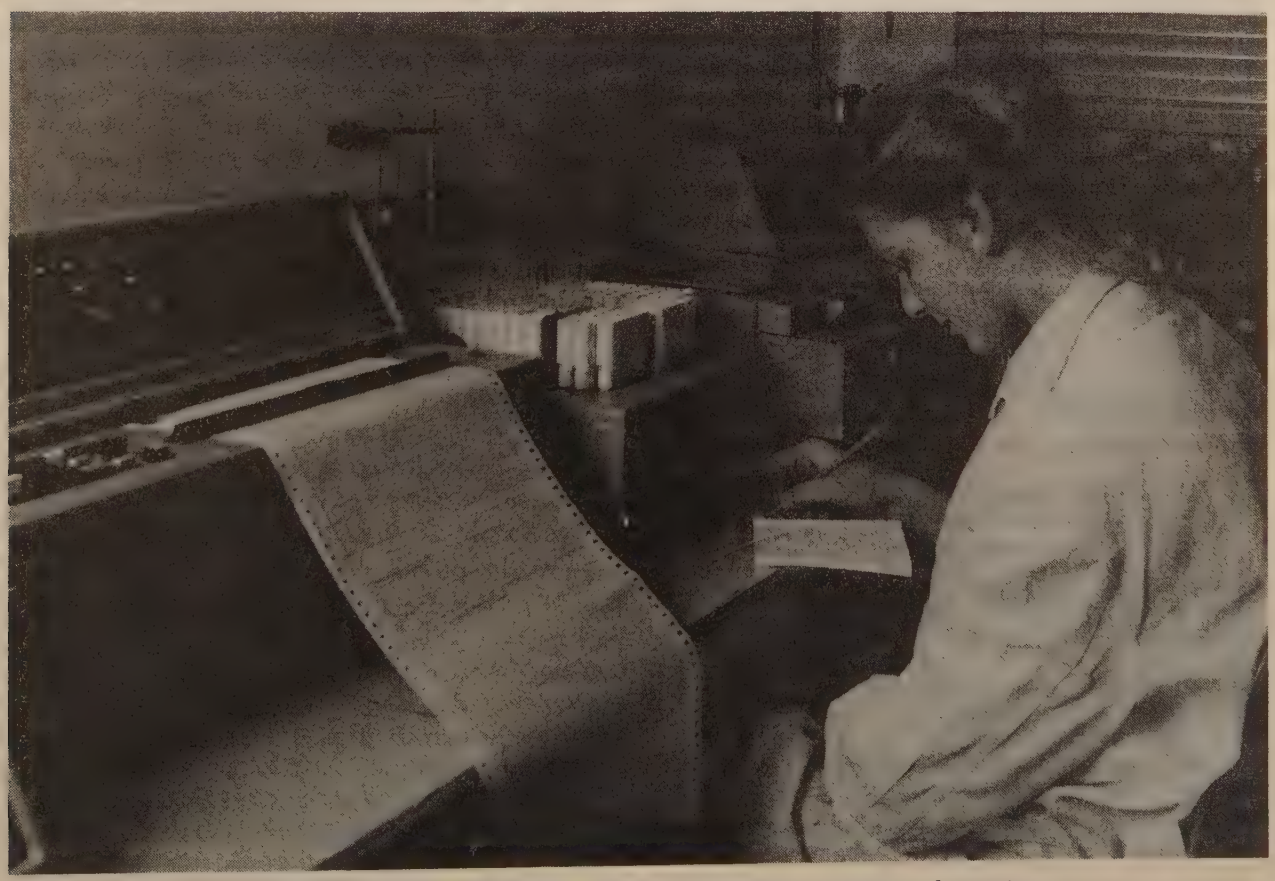
During the past three seasons 32 Sultana, 15 Hanepoot and three currant types, cultivars and clones were evaluated for drying quality. The best drying quality in the various categories of raisin grapes was obtained from the following cultivars and clones:

Sultana types	**(a)**	**Sultana clones - Thompson's Seedless 67 and Friersdale**
	(b)	**Sultana crossings - Fiesta and MH 29/63**
Red Sultana types		**Upington clones, Black Monucca and crossing USW 30/4/1**
Raisin types	**(a)**	**With a muscat flavour: Hanepoot clones H1/980 to H1/986, and especially H1/983; in addition the Middelrus Muscat d'Alexandrie (imported) and Umtali clones**
	(b)	**Without a muscat flavour: Datal, Waltham Cross, M57 and Italia.**
Currant types		**Zante and Cape Currant**
		The berries of McGlew Currant are too small unless hormone spraying is applied.

Breeding of new wine and raisin grape cultivars

About 4 000 grape seedlings were established in plastic planting bags from about 60 crossing combinations made the previous season - the first crossing of the Institute's breeding programme.

All the crossing combinations made with Fraoula produced extremely vigorous seedlings. Fraoula has very long, loose bunches and firm



Analysis of the phenolic components in wine with the aid of a spectro-photometer

flesh, which are desirable characteristics in raisin grapes.

Grafting and nursery practices

An investigation aimed at evaluating the effectiveness of certain grafting techniques was wound up after a period of five years. The purpose of this investigation was to improve the quality of the grafted vines and the percentage take in South African vine nurseries. The results of the investigation, briefly, were the following:

- If the grafting material is sorted in advance, the percentage take in the nursery is more than doubled.
- The best time to gather grafting material is late autumn (May) and/or early spring (September), when the starch content of the dormant shoots reaches a maximum.
- A disinfection treatment with 0,25 % Chinosol solution provides effective control of fungus infection without impairing callus formation.
- The storage of disinfected grafting material in plastic bags at 1 °C to 4 °C improves the percentage take, but higher storage temperatures undoubtedly have a bad effect on the carbohydrate reserves and percentage take.
- Hand grafting produces a higher percentage take than machine grafting, but no differences in the percentage take were found between one and two bud grafts.
- The use of a grafting wax containing a fungicide to counteract moisture losses and physical damage to the graft union improves the percentage taken in nurseries.
- Over half the total carbohydrate reserves of the grafted vine are used up during the callusing process.
- The use of a 90 cm wide black plastic cover in the nursery rows together with the callused graft unions produces consistently good results, especially in soils with a tendency to compaction after rain. It also cuts down on labour since it eliminates the need to remove scion roots later in the season and weed control is drastically reduced.

Cultural aspects

Suckering wine grapes

Indications were obtained that even where a highly significant percentage of shoots and bunches is removed during suckering, the vine compensates to such an extent during the first season that no significant differences in crop and shoot mass can be observed.

Renovation of old vineyards

The possibility of renovating old vineyards without using conventional re-establishment methods was investigated; it would appear that vines grown on low trellises, and particularly bush-trained vines, present considerably more problems than where high trellising systems are used. 74,1 % of the vines treated were successfully renovated by means of two techniques, namely sawing off the stems and re-grafting the vines by means of T grafting. With bush-trained vines the figure was 30 %.

Pruning methods for cabernet sauvignon

The low unit production and poor budding percentage of canes necessitated urgent attention to alternative pruning methods for this, the most important quality red wine grape cultivar in South Africa. In a trial in which seven different pruning systems were evaluated, the normal short pruning method resulted in the best potential production.

Weed control

A. Chemical weedkillers for the control of annual weeds

1. Contact preparations

The efficacy of a locally manufactured formulation of paraquat (viz PQ 24) was equivalent in all respects to that of the imported product (Gramoxone).

2. Systemic preparations

Low doses of glyphosate (about 3 ℓ/ha) provided better control of full-grown annual winter weeds than the contact preparations diquat and paraquat, but the price of the former remains very high. Various MCPA mixtures, especially MCPA plus terbutryn, maloran or fluometuron, provided not only good pre- and post-emergence control of almost all types of annual summer weeds, but also good post-emergence control of yellow and purple nut-grass.

3. Pre-emergence preparations for the control of seedling weeds

The efficacy of a formulation of simazine of South African manufacture corresponds in all respects to that of the imported product.

B. Chemical weedkillers for the control of perennial weeds

1. Soil-residual preparations (which act through root absorption)

a. Control of yellow and purple nut-grass that emerges periodically

Of the preparations that have to be washed into the soil by means of irrigation, metolachlor was the most effective, followed by perfludone and alachlor. These preparations are ineffective against actively growing nut-grass. They also provide poor pre-emergence control of a number of broad-leaved weed species, but control seedling grasses well. For comprehensive pre-emergence weed control of nut-grass and all seedling weeds, the addition of

oxyfluorfen to the above preparation produced excellent results.

b. Control of fine quick-grass

Sulfodiazol and terbacil were effective, but were too toxic to use on vines.

2. Post-emergence preparations (act through leaf absorption)

Preparations which are safe for vines in respect of their soil residues and have a post-emergence effect on fine quick include glyphosate, which is very effective, HOE 29152, which is moderately effective, oxyfluorfen, which is not very satisfactory in the long term when used on its own, the contact preparation paraquat, which has no long-term action, and a selective herbicide.

Irrigation and moisture studies

Studies carried out with Chenin blanc on various trellising systems over a period of two years at Robertson showed that high-trellised vines (high slanting trellis system) do not necessarily use more water than bush-trained vines, as is generally assumed. Under the conditions of the trial the well-known Perold system proved a good trellising system where the water supply is limited. The water consumption per season for the various systems was: Perold - 294 mm, high slanting trellis - 351 mm and bush-trained vines - 404 mm.

The effect of the trellising system on the must and wine quality was studied and found to affect mainly the sugar and acid content of the grapes. Bush-trained vines made the poorest showing and produced low sugar and high acid counts.

The main factor responsible for impairing the quality of the wine was *Botrytis cinerea* rot; the incidence was higher in the bush-trained vineyard than in vineyards on the larger trellising systems.

Fertilising studies

Studies on the periods during which Chenin blanc takes up nitrogen (N), the quantities taken up, and the general increase in mass of the vine, have been completed. This work has shown that there are two unmistakable peak periods of nitrogen uptake, namely after budding and again after harvesting. The practical implications are that N should not be administered too early in spring, as is the general practice at present. The important part the roots play in the N nutritive pattern again emerged clearly. The roots store N until leaf drop, after root growth has already ceased.

It would appear that, in the case of Chenin blanc/99R, 2,6 % N in the leaf blades and 0,9 % N in the leaf stalks during harvesting is an acceptable standard for adequate N nutrition.

Entomology

Margarodes

An intensive study of the morphology and taxonomy of *Margarodes* species that occur in South Africa has been completed. Seven species have been redescribed and two species new to science, namely *Margarodes upingtonensis* De Klerk and *Margarodes vredendalensis* De Klerk, comprehensively described.

All the *Margarodes* species in South Africa are indigenous and attack various species of grasses and shrubs. Five species also attack vines and they occur in virtually all the viticultural areas. *Margarodes capensis* and *M. vredendalensis,* in particular, do serious damage. Comprehensive studies on the biology of these two species were recently carried out in an attempt to develop control measures against the pest.

Disease control

Control of *Botrytis cinerea* or grey rot

Two new contact fungicides were evaluated this year and it was found that they control the disease as effectively as the recently registered Iprodione. These two preparations have no adverse effect on fermentation and wine quality and can therefore be used on wine grapes almost right up to harvesting.

Systemic fungicides against downy mildew

As during the previous season, excellent control of downy mildew was again obtained with several systemic preparations. It was established that aluminium phosphide and metaloxyl compounds can be applied at 21 day intervals, irrespective of the weather conditions.

It was also established that the plant had taken up enough of the fungicide within one hour of spraying in the case of the metaloxyl compound and within three hours of spraying in the case of the aluminium phosphide compound to protect it against downy mildew. In the case of the standard preparations spraying had to be repeated after 15 to 20 mm of rain and further spraying had to be applied at 14-day intervals. The use of the systemic preparations should therefore make it easier not only to control downy mildew but also to cut costs.

Wine chemistry

Optimum ripeness of grapes

Because the sugar: acid ratio had proved to be such a good indicator of optimum ripeness in Steen and Pinotage grapes in the Stellenbosch area, the investigation was extended to Nuy (Pinotage), Durbanville (Pinotage) and Lutzville (Steen) this year. Colombar, which had already been studied at Robertson, was also investigated at Lutzville.

The sugar:acid ratio of Cabernet Sauvignon grapes at Stellenbosch did not show a consistent relationship to optimum ripeness. Nevertheless,

generally speaking the wine quality was good, but not necessarily the best, at a sugar:acid ration of 3, a must pH of 3,55 - 3,60 and °Balling (sugar): pH ratio of 6,3 - 6,4.

Maturation of white wines

Chenin blanc, Riesling (commercial wines) and Colombar (experimental wines made at Nietvoorbij were stored at temperatures of 0 °C, 10 °C, 20 °C and 30 °C. The wines were subjected to periodic chemical and analysis and organoleptic judging for quality, especially with a view to the cultivar and maturation character.

With the aid of a new gas chromatographic method that includes extraction with the aid of Freon 11, esters, higher alcohols and certain fatty acids were analysed. The findings clearly pointed to two practical applications. Firstly, wines can be stored at 0 °C - 10 °C to retain the cultivar character and secondly they can be stored at 10 °C - 30 °C for the rapid development of maturation character. However, the wines of certain cultivars are adversely affected by protracted storage at 30 °C and by higher storage temperatures. Depending on demand, the maturation of white wines can therefore be controlled chiefly by means of temperature.

Statistical relationship between chemical analyses and wine quality

The development of a new gas chromatographic method has made the analysis of more esters and higher alcohols possible. Wines of the cultivars Chenin blanc and Colombar (from Robertson) and Chenin blanc, Pinotage and Cabernet Sauvignon (from Nietvoorbij) were analysed. The new computer programmes were used to carry out multiple regression analyses on these wines, firstly to determine which wine components are the most important in determining wine quality, especially aroma, and secondly to predict these quality characteristics objectively with the aid of the data obtained. This subject is being widely studied internationally at the moment.

The research appears very promising. Equations have already been obtained for predicting the quality of Pinotage wine from the concentrations of hexyl acetate and ethyl octonate in the wines.

Factors that affect the fermentation and the aroma composition

Must purity, produced by settling, centrifugation or filtration, and anaerobic fermentation conditions are among the most important requirements for high quality white wines. However, in these conditions the fermentation is often retarded and may even stick. By adding variable amounts of suspended grape constituents, air or ergosterol to the must, or by applying higher or lower inoculation percentages, any desired rate of fermentation can be obtained.

In the winery the best quality wines were produced by slow fermentations of shiny, filtered grape musts, stimulated by 0,5 g of bentonite/litre and a small quantity of air for musts of various degrees of ripeness.

Reduction of the sulphur dioxide content of wines

Aldehydes and more specifically acetaldehyde are chiefly responsible for combining the SO_2 in wines. Various yeasts were tested during the year under review and a number were selected for low acetaldehyde formation. These yeasts also had a greater capacity to form glycerol, which also tends to improve wine quality.

Preliminary experiments showed that certain yeast races formed more acetaldehyde at 15 °C than at 25 °C. The best wine quality is obtained at 15 °C, however. It would appear from the results that a combination of yeast strain and correct temperature manipulation during fermentation can bring about a significant reduction in acetaldehyde concentrations, which should reduce the SO_2 requirements of the wine, while the quality is preserved or improved.

Effect of the quality of rebate wine on spirits

A pilot trial for studying the effect of the following off-flavours and tastes in rebate wines on the quality of rebate spirits was started:

1. Rancidity
2. Flavour produced by mannitic bacteria
3. Bitterness, with a flavour of tannin
4. Astringency

Unfortunately these off-flavours do not occur singly in wines, but in combination with others. One flavour always predominates, however. In order to investigate the effect of astringency, a series of wines with different polyphenol concentrations were made at Nietvoorbij and submitted to the Brandy Board. A panel of 12 judges evaluated the brandies for nose and flavour. A judge's card on which the various properties of brandy are clearly shown was drawn up for the purpose. The results of the preliminary investigation show a strong correlation between rancidity in the wine and in the brandy in two samples. A rebate wine initially judged to be rancid by the Brandy Board showed no signs of rancidity when the time came for it to be distilled. A good correlation was also obtained between the aldehyde concentration and the quality of the brandy. High aldehydes resulted in cautions or rejections by the tasting panel. Brandies distilled from rebate wines with 500 mg/ℓ or more polyphenols were rejected as hard, rough, sharp and tasting strongly of aldehydes. This investigation is being continued. A wider range of off-flavours will be studied.

Liquor control

Wine certification scheme under Act 25 of 1957

Table 1 is a summary of the quantities of wine certified for sale by the Wine and Spirits

Board, with indications of origin (estate wine included), grape cultivar and vintage.

TABLE 1 - Certification of wines of origin and cultivar and vintage wines

Type of wine	Total certified	Superior quality		Special quality	
	hℓ	hℓ	%	hℓ	%
Unfortified wines	167 330	9 762	5,8	157 568	94,2
Liqueur wines and other fortified wines	41 036	4 556	11,1	36 480	88,9
Total	**208 366**	**14 318**	**6,87**	**194 048**	**93,13**

In all 38 165 hℓ (22,4 %) more wine was certified this year than the previous year. This may be ascribed to an increase of 45 445 hℓ (37,3 %) in the case of natural wines. On the other hand, the figure for fortified wines dropped by 7 280 hℓ (15 %) this year. The reason is that fortified wines are certified chiefly for export and exports of this type of wine dropped considerably during the past year.

The total quantities of natural wines certified, expressed as a percentage of the total sales of this type of wine (local consumption plus exports) also show a gradual increase. This is apparent from the fact that the percentages involved amounted to 5,7 %, 7,0 % for the years 1976, 1977 and 1978, respectively. In the case of fortified wines the corresponding percentages were 9,6 %, 6,7 % and 6,3 %.

Inspection of rebate wine, brandy and wine spirits

Table 2 contains particulars of the inspection for quality by the Government Brandy Board of wine intended for certification for distilling into wine spirits, as being suitable for the manufacture of potable alcoholic beverages.

TABLE 2 - Certification of rebate wine, rebate brandy and wine spiritus

Type of wine or spirits	Total inspected Samples	hℓ	Approved hℓ	% rejected, Volume
Rebate wine	2 184	1 116 974	1 059 484	5,14
Rebate brandy	388	114 403	113 662	0,64
Wine spirits	661	278 026	273 602	1,59
Low-strength spirits	35	7 835	7 611	2,85

The figures in the table indicate that during the 1979 vintage 28 % (232 176 hℓ) more rebate wine was certified by the Board as suitable for distilling into rebate brandy than during the previous season. This is the largest quantity of wine ever approved for this purpose, although the trend towards distilling more pot still brandy has been evident for the past four seasons. The reason is probably the reduced demand for good wine and the consequently greater supply of distilling wine and rebate wine.

Quality control of export liquor

The Wine and Spirits Board inspected, both by means of organoleptic testing and chemical analysis, 2 495 samples of export liquor (representative of 91 238 hℓ of wine and spirits) for quality under the Liquor Export Regulations. Of this quantity 2 447 samples, representative of 91 096 hℓ, were certified for export.

Exports during the past year again showed a slight decline (0,5 %) as against a decline of 27 % during the preceding year. It is encouraging to note, however, that despite the decline in total exports, exports of bottled unfortified wines increased considerably over the past few years. Exports of bottled unfortified wines were 43 % higher (6 690 hℓ) than the previous year and have risen by 152 % (13 450 hℓ) since 1975/76.

Control of imported liquor

All imported liquor is controlled in terms of Act 25 of 1957, since the provisions of this Act also apply to the composition and labelling of imported liquor offered for sale in the Republic. Control is exercised in close co-operation with the Department of Customs and Excise.

A total of 717 consignments of liquor were sampled at clearing points by customs and submitted for analysis by the Routine Analysis Section of the OVRI, and for checking of the labels.

Local liquor inspection service

Under Act 25 of 1957 liquor inspectors travelled 61 237 kilometres during the past year, inspected 1 522 premises licensed for the manufacture and retail sale of liquor and tested a total of 63 496 samples of liquor at such premises.

Routine analysis services

The routine analysis section of the OVRI is the only official laboratory in the Republic appointed under Act 25 of 1957 where liquor is analysed by chemists.

The extent to which the service supplied by this laboratory is expanding is apparent from the fact that 17 424 samples were analysed during the past year, which is an increase of 33 % over the previous year.

Agricultural technical relations with overseas countries

South Africa is a member of the OIV (International Wine Office), which has its headquarters in Paris. South Africa holds a special place in this organisation in that it has four votes in the general assembly, which places it on almost the same level as France, Italy, Germany and Spain. South Africa participates actively in the activities of the OIV, as is apparent from the following:

1. A South African was vice-president of the General Assembly in 1977 and 1978.

2. A South African is Secretary to the Third Commission of the OIV.

3. South Africa has just been nominated to serve on the Financial Committee of the OIV for the next two years.

Delegates from South Africa regularly attend congresses and general assemblies, and in 1977 and in 1978 South Africans were invited to deliver lectures at OIV congresses. A South African has already been invited to deliver a lecture at an OIV meeting in 1980. The Director and Deputy Director of the OVRI attended the congress in Athens in September 1978 and the general assembly in Stuttgart in May 1979, respectively.

CITRUS

Nursery practices

Techniques for preparing seedlings for earlier budding, while at the same time saving nursery space, are being tested at present. Citrus seed is normally planted in beds. The soil in the beds has to be fumigated beforehand to purify it of parasites and then thoroughly leached with water to get rid of chemical residues. Standard seed beds are 1 x 6 m in size and contain 1 600 seedlings. Seed beds are normally in the open or protected by no more than a lath house. Because it has been subjected to exposure the seed cannot be planted before the end of the winter and then at least six weeks are required for the seed to germinate.

A coarse vermiculite : sand mixture (1;1 on the basis of volume) is now used instead. Standard light plastic containers (110 mm x 50 mm) are filled with the vermiculite : sand mixture up to 15 mm from the top. Two hundred citrus seeds are placed on the medium and covered with it.

Germination is very good and seedlings develop very fast. If the tap-roots reach the bottom of the containers too soon, deeper containers can be used.

Eight of these small containers take the same number of seedlings as a standard seed bed. The small containers can be kept in a growth tunnel or any other warm place at minimal cost. This makes it possible to plant the seed as early as May.

Registration of plant breeders' rights

At the recent meeting of UPOV (the international organisation for the protection of plant breeders' rights) in Corsica the guidelines drawn up for citrus were discussed. South Africa has taken the lead in this particular field. An officer of the Division of Plant and Seed Control has been seconded to Nelspruit on a full-time basis. She is engaged in refining the guidelines and testing them in practice. All the important cultivars are being studied on the basis of the guidelines in order to draw up comprehensive morphological descriptions of each cultivar. The next UPOV meeting will be held in South Africa, in 1980.

Chemotaxonomy

It is sometimes very difficult to identify citrus cultivars purely on the basis of morphological differences. Chemotaxonomic methods are being evaluated as an aid to identification. It is already possible to distinguish between species with certainty.

This technique can also be used as an aid in the granting of breeders' rights for plants. Chemical markers can also be used.

Looseskin citrus

In view of the economic value of looseskin citrus, intensive attention was given to this project during the past season. Various consignments of fruit from the experimental orchards at Messina, Letsitele, Burgersfort, Nelspruit, Rustenburg, Addo and Citrusdal were sent overseas for evaluation. Relatively large numbers of cultivars were involved in these plantings.

The reports received so far in respect of the quality of fruit from the hotter parts of the country are not very promising, but the first report on fruit from the Eastern Cape was more encouraging. It would appear at this stage that the cultivars Nova, Robinson, Lee and Osceola were not favourably received at all, although Fairchild and Page could be an economic proposition in some areas from the point of view of fruit quality.

Other bodies concerned with the development of the looseskin industry submitted consignments and favourable comments were received on Satsuma and Clementine from certain parts of the country.

Replanting problems

Long-term field trials show that soil fumigants such as DD and methyl bromide result in significantly better growth and production in navels and Valencias on rough lemon rootstocks, even after 16 years (DD), than can be obtained on untreated old citrus soil.

Pot trials with seven well-known citrus rootstocks indicate that *Poncirus trifoliata,* Swingle citrumelo and Cleopatra mandarine show significantly poorer growth on old citrus soil than on veld soil. These three rootstocks are also poor hosts to the citrus nematode. Rough lemon, Troyer citrange, Carizzo citrange and Empress mandarine grow less well in old citrus soil.

Indications were found that the decomposition of rough lemon roots in poorly aerated conditions releases toxic substances that suppress the growth of rough lemon seedlings.

Brack problems

Pot trials are being carried out to observe the effect of various salt concentrations in the soil on a number of important rootstocks. Apparently

During the year under review trees of various easy peeler citrus plantings at Letsitele, Nelspruit, Rustenburg and in the Sundays River Valley were covered with gause for the duration of the flowering season. The effect of cross-pollination on production, seed content and fruit size were investigated in this way

TABLE 1 - Length of period (in days) from planting in May until seedlings are ready for transplanting into large plastic bags. Rough lemon seed used in all cases

Seed	Planted in small containers		Planted in open-air seed bed
Seed	In tunnel	Open-air	
Peeled	30 days	90 days	no germination
With seed-coat	75 days	105 days	240 days

the Cleopatra mandarine is the rootstock with the greatest tolerance of brack soil, followed by the rough lemon, the Citrumelo and the Troyer citrange. *Poncirus trifoliata* is the most sensitive rootstock in the series and is very badly affected by a high level of salts in the soil. Rough lemon seedlings take up large quantities of chlorine - an unexpected finding. The following step is to determine whether this response by the rootstocks affects the scion.

Crop forecasting for the Citrusdal area

Temperature data for the period from flowering (September) to the end of November is used to predict the size of the citrus crop for the Citrusdal area. The forecast for the 1978 crop was pretty accurate, the figure forecast for navels being 1,5% too low and that for Valencias 6,6% too high. The forecast for a particular season is done as early as December.

Plant nutrition

Magnesium deficiencies are very common in citrus; according to research results they can be rectified by a single application of 2 to 3 kg of magnesium oxide per tree. However, this recommendation applies only to soil with a pH (water) below 6,8. At higher pH levels magnesium sulphate should be applied in quantities of no less than 5 kg per tree.

Entomology

Screening of new pesticides

Five pesticides intended for use on citrus were sprayed in a screening experiment carried out at Rustenburg. A pyrethroid, cypermethrin 20% ec (Ripcord) at 0,004% a.i., caused a severe increase of the citrus red mite, *Panonychus citri* (McGr.), and the karoothorn mealybug, *Nipaecoccus vastator* (Mask.), both of which had to be sprayed out. Red scale, *Aonidiella aurantii* (Mask.), also increased to above the economic threshold.

Nematodes

In the Sundays River Valley 26 year-old Valencia trees were treated with phenamiphos applied in flood irrigation basins. The treatments were found to cause both significant reductions in citrus nematodes and yield increases equivalent to 7,0 tons/ha.

A general survey of the Eastern Cape citrus areas has shown that the citrus nematode is present in almost all the orchards of the Sundays River Valley, at exceptionally high population levels. The Kat River, Fort Beaufort and Patensie areas, which have the same characteristics as the Sundays River Valley, are regarded as potential problem areas.

False codling moth

Where a programme consisting of the use of sex traps and the release of the egg parasite *Trichogrammatoidea lutea* for the duration of the season was applied in a navel orchard in the Eastern Transvaal Lowveld, losses as a result of false codling moth damage were reduced. The undertaking was economically justified.

The false codling moth situation in the Citrusdal valley was considerably better this season than last season, which may be ascribed largely to the importation and establishment of the egg parasite *T. lutea.*

Greening and psylla

The psylla was brought under control and the incidence of greening reduced when eight year old Valencia trees were treated with a stem injection of dimethoate and tetracycline (singly or combined). Dimethoate residues in the fruit were within the tolerance limit.

Dimethoate/bromacil interaction

Experimental findings indicate that it is dangerous to administer dimethoate in soil where bromacil (Hyvarx) has been administered previously.

Pathological aspects

Considerable success having been achieved in the control of greening by means of chemotherapy, the emphasis has now shifted to the prevention of virus diseases. Indexing methods, the relative resistences of rootstocks and the use of mild strains in cross protection are being investigated.

PINEAPPLES

Nematodes

The monitoring of nematode populations in plots planted to various grass types and legumes indicated that *Chloris gayana* cv Katambora, *Desmodium intortum* and *Eragrostis curvula* cv Ermelo are effective in reducing root-knot and spiral nematode populations in old pineapple lands. Siratro, *Macroptilium atropurpureum* also appeared promising for the reduction of root-knot nematode infestations.

Nematocide screening trials have shown that carbofuran and AC-64475 are as effective as standard soil fumigants for the control of root-knot nematode infestations. 1,3-Dichloropropene has also been tested and found to give better control of nematodes than D-D, although 1,3-D appears to retard plant growth slightly.

Work with oxamyl and fenamiphos has indicated that good control of root-knot and lesion nematodes can be obtained from post-planting foliar sprays alone, without the need for pre-planting fumigation or a planting material dip.

Herbicides

The herbicide Velpar has been extensively tested in pineapple lands for the control of species of the grasses *Paspalum* and *Panicum,* with very promising results.

Plant selection

A Smooth Cayenne selection developed at Bathurst Research Station was released to the pineapple industry in 1978. Currently a Smooth Cayenne selection developed at East London is being multiplied for release in 1980. This latter selection has, in field trials, outyielded local field run plants.

The work on chlorflurenol for the rapid multiplication of pineapple planting material has been completed.

Growth regulants

Tests have shown that ethephon was more effective for the flower induction of ratoon suckers than ANA or BOH. In the Levubu pineapple producing area, ethephon also proved the most effective flower inductant, particularly when urea was added to the spray.

Fruitone CPA at 4 ℓ/ha in 2 000 litres of water had produced dramatic increases in fruit mass - up to a 30 % increase in the case of Smooth Cayennes and a 40 % increase in Queens.

Pests

Mites

Acaricide screening trials have shown that endosulfan is still the most effective product for the reduction of leathery pocket when applied 4 weeks before forcing.

Mealybug

Methyl bromide provided good control of mealybug as a pre-planting fumigation treatment of planting material. Dipping planting material in mercaptothion, diazinon, methidathion or dimethoate also proved effective.

Post-planting spraying with dimethoate, mercaptothion or diazinon were very effective for mealybug control, although two or more sprayings are required.

Fruit Waxing

An evaluation of three fruit waxes has shown that polyethylene wax resulted in the lowest fruit moisture loss from Smooth Cayenne stored for 21 days at 8 °C, and then for 14 days at the ambient temperature.

Plant nutrition

Research over the past few years has revealed that phosphorus and potassium fertilising, which has to be applied before planting, is necessary only if a soil analysis indicates a deficiency.

The importance of magnesium was confirmed. Magnesium oxide, in particular, produced very good results. Preliminary results indicate that the cheaper dolomitic lime is very effective for pineapples.

The required applications of nitrogen are fairly standardised. It was found, however, that nitrogen should be more regularly applied in the hotter areas.

SUBTROPICAL FRUIT

BANANAS

In the course of the project on leaf growth and flower and fruit development it became evident that at Burgershall development from the young sucker to the harvestable bunch takes about 850 days. At Levubu the development period was about 810 days.

Seasonal differences in respect of leaf development were also measured. Maximum leaf growth was measured at Burgershall during the period November to March, and at Levubu maximum growth took place from October to February.

Feeding

The importance of potassium fertilising in soil low in potassium was confirmed in a nitrogen/potassium fertilising trial. The effect of nitrogen on production was very slight in comparison with that of potassium.

Nematodes

In the past there was no systemic preparation registered for the control of nematodes in bananas. Trials carried out over the past three years have now been successfully concluded and aldicarb (Temik) has been registered for use on bananas.

Storage

Iprodione, a contact preparation which, according to the manufacturer, has a wide spectrum of activity, was tested together with thiabendazole (TBZ) and benomyl for the control of collar rot and compared with an untreated sample.

The results show that although iprodione was extremely successful in other subtropical fruit, it did not perform as well as the old favourites (TBZ and benomyl) in this case.

The possibility of extending the shelf life of bananas by means of wax preparations was also investigated. In this investigation bananas were dipped in TAG wax, at various strengths, immediately after harvesting and then ripened in the ordinary way. The ripe fruit was compared with an untreated control sample in respect of colour, firmness, spoilage, uniformity and lesions. The differences between the treatments were disappointingly small. It would appear, however, that wax applied at full strength retarded ripening (colour, firmness and spoilage) slightly. The fruit immersed in full strength wax had a generally unattractive appearance, so nothing is gained by waxing bananas.

Determining the firmness (ripeness) of bananas with the aid of the existing pressure tests has always been a problem, because the fruit can be damaged or destroyed in the process and repeated testing is therefore not possible. A new "Fermometer" designed and built at the Citrus and Subtropical Fruit Research Institute, which apparently does not damage the fruit, was successfully tested during the season.

AVOCADOS

A number of new avocado cultivars were imported. The cultivars Bacon, Topa Topa, All Boyce and Teague bear a very good crop at 2½ years.

Feeding

Results obtained in a fertilising trial over several seasons confirm that avocados are capable of producing high yields with a minimum of fertilising. On the other hand, it was found that the application of excessive quantities of nitrogen has an adverse effect on production.

Storage

Problems experienced with determining the ripeness of avocados in the past were successfully solved during the past season with the aid of the "Fermometer" designed and built by the CSFRI. With the aid of this equipment, which measures how much a fruit yields when a specific pressure is exerted on it, the same fruit can be tested repeatedly without becoming damaged.

Preliminary trials carried out with a "Fermometer" during the past season revealed, *inter alia,* that avocados do ripen to some extent during storage.

During the past season the effect of seasonal changes on the keeping quality of Fuerte avocados exported by sea was studied. It would appear that anthracnose spoilage depends on temperature and atmospheric moisture. The higher these two factors, the more anthracnose spoilage can be observed on the fruit.

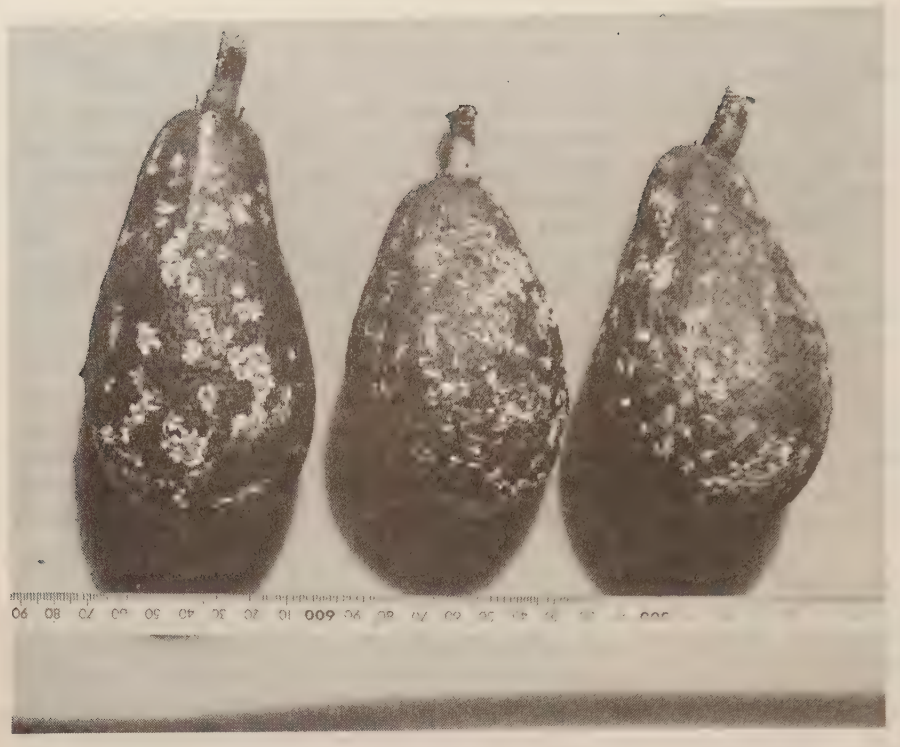
Cold damage is also related to temperature. In this case it appears that fruit harvested during the hot part of the season is less resistant to the low storage temperatures used for avocados.

Stem-end rot, like anthracnose, depends on high temperatures. Lead discolouration appears rather to be a function of normal aging of the fruit, because this abnormality increases in proportion to the length of time the fruit remains on the tree.

MANGOES

Cultural aspects

The mango industry is continuing to expand, and new plantings are being established. In an



False codling moth blemishes on avocados

attempt to obtain cultivars with a high fruit quality that are adapted under South African conditions, an orchard of 2 000 mango seedlings was planted, 800 of which are already in bearing. Five promising trees from this orchard were marked for further evaluation.

A pruning trial has been completed: Four pruning systems aimed at bringing old and unproductive trees into full production again were tested. The best pruning method appears to be the application of selective pruning. Each alternate tree is severely pruned back. The remaining trees bear a crop while the pruned trees are growing back to size. As soon as the renovated trees come into bearing, the remaining trees are pruned back. Upon the completion of the cycle all the trees have been renovated.

Storage

Good results in controlling post-harvest spoilage of mangoes have been obtained in the past by immersing the fruit in a hot (55 °C) suspension of 1 g/ℓ of benomyl for five minutes. During the past season a new preparation, iprodione, was tested together with benomyl and it would appear that the new preparation produces even better results than benomyl, which is at present registered for use on mangoes.

PAWPAWS

Several fungicide trials were carried out on pawpaws during the past season in an attempt to control post-harvest spoilage. Some of the best results were obtained from the new contact preparation iprodione, which reduced spoilage from 67,4 % (in untreated fruit) to 24,9 %.

In combination with other preparations such as dicloran, thiabendazole and benomyl, this preparation produced even better results and a post-harvest spoilage figure as low as 18 % was obtained.

LITCHIS

The litchi industry is still showing sound development and production increases have kept pace with demand.

A trial in which the growth and production of grafted litchi trees were compared with those of trees grown from air layers has been completed. It became apparent that grafted trees were easier to establish in an orchard, since the trees had a stronger root system.

During the first three years after planting, the grafted trees grew faster and better than the air-layered trees, also because of the stronger root system. After this the air-layered trees caught up and the differences in size, growth and bearing were wiped out.

Root studies showed that grafted trees have a well-developed, deep taproot system down to a depth of two metres. The air-layered trees have an adventitious root system to a depth of 1,5 metres.

Feeding

The importance of nitrogen for the production and fruit quality of litchis was demonstrated over the past three seasons. Phosphorous and potassium were relatively unimportant. Leaf analyses were necessary for monitoring the optimum level of nitrogen application.

GUAVAS

There is still a great deal of interest in the guava industry, especially with regard to juice

extraction, drying and the exporting of fresh fruit.

A selection programme aimed at finding suitable varieties for specific markets is in progress. An orchard of 4 000 seedling trees was planted, 400 of which are in bearing at present. Five very promising plants have already been selected.

Projects aimed at testing a pruning system and pruning times are being carried out at the Levubu Experimental Farm. So far it would appear that October is the most advantageous time to prune.

KIWI FRUIT

This is a new kind of fruit which is arousing a great deal of interest and meeting with great success on overseas markets.

An orchard of seedling plants has been planted, and the first plants are already in bearing. Two promising plants have been selected from this orchard and are being multiplied for further trials at present.

One hectare of plants of the cultivar *Hayward* has been established for evaluation, and for training and pruning trials under South African conditions.

MACADAMIA NUTS

An important pest of macadamia nuts, namely the green vegetable bug *Nezara viridula,* which also occurs on several other crops in South Africa, is being bred by the CSFRI. The purpose is to breed a parasitic fly, *Trichopoda pennipes,* which was imported from Hawaii in May on the bugs and later release the fly in all macadamia areas in an attempt to control the pest by biological means.

PECAN NUTS

The annual production of pecan nuts in South Africa is still increasing.

A new zinc formulation, NZN, was compared with the standard zinc oxide and zinc sulphate sprayings and soil dressings of zinc fertiliser. The uptake of zinc with NZN was far better than with any of the other treatments. This finding is of great value to pecan nut producers, since a zinc deficiency reduces the nut crop considerably.

TEA

A study to determine suitable temperature values for tea-growing in South Africa is being undertaken at present. The data are being charted so that recommendations can be made on new tea-growing areas.

The selection trial is progressing favourably and 10 selections are undergoing further testing.

FLOWERS AND ORNAMENTALS

PROTEAS

Exports of cut proteas during the past season increased by 35% of the figure for the previous season. Protea sales nevertheless represent an insignificant share of the European flower market. The industry therefore has excellent potential for expansion. Protea production is increasing mainly in the Transvaal. A sizeable industry is developing there because the flowers are fairly free of diseases and pests and the production area is relatively close to the air export terminal.

The most popular varieties on all the markets remain the king protea *Protea cynaroides,* the sugarbush protea *P. repens* and the pincushion protea *Leucospermum cordifolium.*

A very important development during the past year was the release by the Department of five new *Leucospermum* cultivars to the industry. The five cultivars were all bred or selected by private nurserymen and donated to the Department to be made available to the industry. It was found that in all five cultivars flowering can be delayed by four to six weeks by the application of the growth regulant ethephon, without any reduction in the yield. Flowers of the new cultivars can therefore be produced closer to the peak demand period on the European markets than is the case with the standard *L. cordifolium.*

Trials during the past season have shown that a plastic cover of the type used for grapevine cultivation is ideal for protea cultivation. The plastic cover has a very good effect on the survival, growth vigour, preservation of soil moisture and weed control in proteas established on cultivated soil.

In a trial on chemical methods of disinfecting soil infected with *Phytophthora cinnamomi,* the preparation methamsodium appeared very promising.

ROSES

Cultivar rootstock trials with roses

Although the cut rose industry has shown satisfactory expansion during the past decade, there is plenty of opportunity for further expansion, especially in respect of the exporting of flowers to Europe.

The poor keeping quality of roses, combined with the long distances to the European markets, is the biggest problem of cut rose producers. The Horticultural Research Institute is at present investigating post-harvesting treatment for cut roses. Matters receiving attention include the correct picking stage and treatment with chemical preparations to ensure that roses will still have a good vase life and be of high quality after the period spent in transit to the West European markets.

LACHENALIAS

Attempts are being made through breeding and selection to develop this indigenous flowering bulb into a new commercial cut flower or potplant.

The breeding programme is now so far advanced that it will be possible to release selections within the next few years. Promising yellow, orange, red, purple and blue selections with a large number of flowers and good keeping quality have been obtained from the breeding programme.

Because lachenalia bulbs multiply fairly slowly, a new breeding strain has to be cultivated for a number of years in order to obtain sufficient bulbs to release adequate quantities to the industry. However, by studying the technique of tissue culture with lachenalia bulbs a method was worked out by which about 10 000 bulbs can be multiplied from one bulb within a period of four months. This technique is being used to multiply large quantities of bulbs of promising lachenalia breeding strains in order to supply sufficient bulbs to the industry.

One of the lachenalia breeding strains that was suitable for release as a new cultivar developed symptoms of disease. With the aid of the electron microscope it was established that the strain was infected with a rod-shaped virus. Clones of the strain have now been purified of the virus by means of heat therapy and meristem tissue culture. These clones are now being multiplied by means of tissue culture and tested for horticultural purity before undergoing further multiplication for release as a new cultivar.

ORNITHOGALUMS

Twelve selections are undergoing final evaluation this year with a view to possible release. All the selections have a good keeping quality as cut flowers, yield well and have long stems. The range of colours includes white, white and black, pale yellow and pale orange. The coloured selections are particularly important since only white ornithogalums were marketed in the past.

Tissue culture multiplication has been so successful that the first selections may possibly be released next year. By using this method of multiplication it is possible to produce about 20 000 marketable bulbs from a single bulb within the space of six months. These breeding strains were also studied under the electron microscope to determine the presence of viruses. The tests were negative and it will therefore be possible to supply the industry with virus-free material when the breeding strains are released as new cultivars.

GLADIOLUS

The gladiolus collection was further expanded and a number of promising species were collected by the Institute and received from private persons and other bodies. Further crossings of the pure species were made and the first combinations should flower this season. One of the main aims of this breeding programme is to breed resistance to disease into the existing cultivars.

FLOWERING POT PLANTS

INDIGENOUS PLANTS

Numerous species indigenous to Southern Africa have been studied with the object of determining whether it would be possible to use them as commercial flowering pot plants. Research has been directed especially to finding plants capable of meeting the stringent requirements for successful economic production for the market.

One species which continues to be very promising is *Hypoestes aristata*. It is easy to propagate from cuttings, can be induced to flower at any required date by the application of a short-day treatment and is available in colours ranging from pale mauve to deep purple. It has a production period of about three months under normal glasshouse conditions.

Other indigenous plants which are now showing distinct promise for commercial production are two *Plectranthus sp.* The species *Ruttya fruticosa* also appears attractive. They all satisfy the requirement of easy propagation, can be shaped to the necessary dimensions and have a reasonably short production time.

Regal Pelargoniums

Regal pelargoniums are sensitive to both temperature and day length and normally have to undergo a period of short days before flowering, since the days lengthen in spring and summer. However, the requirements for short days can be replaced by a period at low temperatures.

It has been found that by keeping plants at a comparatively low temperature for a few weeks, they can be forced to bloom at practically any time of the year. By making use of this property it was possible to work out a programme for the rapid production of flowering pot plants.

Diseases of flowering plants

Unmarketable flowers and misshapen leaves have recently been common in certain arum lilies. *Zantedeschia elliotiana* and *Zantedeschia rehmannii* are particularly badly affected. Sap inoculation studies for viruses with indicator plants were negative for viruses but long rod-shaped viruses were observed with the aid of the electron microscope.

Carnations received from flower farmers were found to be infected with two viruses. The plants are now being purified of viruses for the industry.

A large number of chrysanthemums were received from flower producers for testing for the presence of viruses. Sap transmission techniques to indicator plants were used; asparagus virus was found in cultivars such as Indianapolis and Snow Crystal and chrysanthemum virus B in Rosado. Some of the plants were subjected to heat therapy

A solar heater at the Horticultural Research Institute, Roodeplaat, is used for heating water which in turn heats a glass-fibre house during the night to protect tomatoes against low temperatures

and growing point tissue culture and one cultivar, Sybil, has already been purified of the viroid infection.

Anthracnose was found on the stems of roses from Natal. The fungus that causes the disease, *Colletotrichum gloeosporioides,* occurs on several plants in South Africa, but this is the first time it has been found on roses in this country.

Dieback of rose trees is a common problem in South Africa. A number of organisms may be involved. Very little dieback was encountered in a trial with rose cultivars grown in a shade house, whereas the problem is common in roses grown in the open sun. It therefore appears that sunburn of the shoots and stems may have an effect on the susceptibility of the rose to the diseases that cause dieback.

VEGETABLES

TOMATOES

The objects of the breeding programme are still the same, namely to breed cultivars with tolerance to diseases and resistance to nematodes in addition to outstanding quality characteristics. Breeding is carried out at Nelspruit, Roodeplaat and Elsenburg.

Market tomatoes

At Nelspruit the cultivar Floradade was crossed with the breeding strain Ld2048, which is resistant to bacterial wilt. The progeny of this crossing were back-crossed to Floradade and the F_4 plants were tested for resistance to bacterial wilt. Plants of this crossing were the first tomato plants with resistance to bacterial wilt capable of producing fruit of a quality acceptable for marketing through the ordinary channels. Breeding to purify these strains is continuing.

The progeny of the crossing between Karino and Piersol VFN (L300/151) were evaluated during the past summer together with Manapal and Piersol, with very good results. The breeding programme to develop resistant strains with larger fruit is proceeding. The crossing progeny in this programme showed a high percentage of resistance.

Factory tomatoes

The breeding programme was continued with the aim of developing the same resistance to diseases and nematodes as in market tomatoes.

Large numbers of strains and selections were subjected to further tests and the best strains were selected for further purification.

In the Nelspruit breeding programme for resistance to bacterial wilt, 48 strains were tested for resistance in the fourth and fifth generations. A considerable amount of this material showed a high degree of resistance. The programme also made good progress at Roodeplaat.

The evaluation of new cultivars and advanced breeding strains was continued at all these stations. It appears from the results that Floradade, Karino and Heinz 1370 are well adapted as market tomatoes in all areas.

The numerous new cultivars for factory processing imported during the past few years were tested in all parts of the country. Because of the interest in production in the Northern Cape, intensive experimental work was continued at the Rietrivier Research Station. According to the

results of the first year this area is one of the best in the Republic for the production of factory tomatoes. No disease problems were encountered and yields were as good as or better than those at any other substation. Producers were especially impressed by the firmness, production and quality of cultivars that bear large fruit, such as Mecheast. Nevertheless, the smaller types, such as UC82, Rossol and VF134-1, produced the highest yields.

Protected cultivation

Research on this method continued at Elsenburg and Roodeplaat. Trials with electric cables for heating and thermal screens to produce more heat during winter and reduce radiation of heat at night proceeded at Roodeplaat. The results confirmed the findings of the previous year, viz that no single technique or combination of techniques had any significant effect on yields or fruit quality. Apart from the capital outlay, the running costs incurred on electricity made this method uneconomic.

Another method of counteracting unfavourable winter temperatures is being investigated. The Horticultural Research Institute at Roodeplaat erected a large solar heater which is in full operation at present.

The effect of bunch pruning on fruit size and yield was studied at Elsenburg. Both properties were improved, but not sufficiently to compensate for the additional labour.

UC 134, a cultivar developed at UC Davis for mechanical harvesting and bred for resistance to fusarium wilt (race 1) and verticillium wilt proved to be considerably more resistant to bacterial canker than Roma VF in the tests.

A breeding strain, L2024, which proved to be very resistant to bacterial wilt *Pseudomonas solanacearum* in trials at Nelspruit (Friedenheim) also showed considerably higher resistance to canker than the standard cultivar Roma VF in glasshouse trials at the Horticultural Research Institute. Monense, a cultivar bred in France for resistance to canker, was also more resistant than Roma VF.

The root immersion method of infecting tomato plants with *Verticillium dahliae* has been modified and is now very effective. This technique has the advantage that the seedlings experience little or no shock during transplanting.

By using this infection technique it was demonstrated that tomato plants infected at the six-leaf stage under field conditions produce a significantly lower yield than plants infected at the four-leaf stage.

DWARF GARDEN BEANS

Several good breeding strains which have the properties sought after in the breeding programme were developed; these properties include resistance to halo blight, tolerance of rust, an upright growth habit and a habit of bearing high, which makes them suitable for mechanical harvesting, good yielding properties and good pod quality. These breeding strains are at various stages of development.

The disease-resistant breeding strain 265/61-3-1, which has attractive pods the thickness of a pencil with good keeping quality, produced a yield of 14,9 t/ha in a cultivar trial (with 18 other cultivars) at Roodeplaat, as against an average for the trial of 13 t/ha. It also produced some of the straightest and most attractive pods. This breeding strain should be released shortly, specifically for fresh packing for export purposes and for local supermarkets.

PEAS

During the past year very good progress was made with breeding for outstanding plant, pod and berry properties in both green and dry peas and for better adaptation to climatic conditions.

Seven green pea strains were bred for better adaptation to unfavourably high temperatures, and a number of single plant selections were made for good bearing and pod properties. These strains grew very satisfactorily under the unusually high temperatures and dry conditions that prevailed during the planting period from the middle of February 1979. These strains can be planted in the Middleveld and Highveld at the beginning of February or even earlier, which makes it possible to harvest before the pods can be damaged by the low April and May temperatures.

Two promising green pea breeding strains will be evaluated in 1979 by the Division of Plant and Seed Control for purity and possible release to the seed trade.

A number of green and dry pea selections of leafless plants were made - they appear very promising but do not yet meet all the requirements.

Co-operative trials carried out in Natal over three years showed that successful commercial production is possible in the irrigation areas at Weenen and Winterton, provided planting is carried out from the beginning to the middle of May at Weenen and from the middle to the end of July at Winterton.

One year's experimental results at Roodeplaat showed that the most important of the present New Zealand cultivars do not produce a significantly higher pod yield than the cultivars Mars, Dark-Skinned Perfection and Cape Freezer, which are widely grown in South Africa for freezing and canning.

PUMPKINS AND SQUASHES

Very good progress was made with the breeding of a flat white Boer pumpkin with the desirable fruit shape and flesh colour. The thick layer of green tissue under the skin is a drawback, especially undesirable for freezing, which is attracting increasing attention from researchers. A flat white Boer pumpkin selection developed by the Horticultural Research Institute at Roodeplaat does not have this layer of green tissue under the skin

and is already sufficiently pure for seed to be multiplied during the coming season by means of open pollination in isolation.

Because there has been a great deal of interest over the past few years in the field-pumpkin that belongs to the species *Cucurbita moschata,* the Horticultural Research Institute has been working on this species since 1974. Processors have shown interest in this species of pumpkin for freezing. A factory in the Transvaal froze 200 tons during the past season. The available field-pumpkin material varies considerably, but inbreeding and selection have greatly helped to eliminate the great variation in fruit shape, and susceptibility to sunscald and cracking and to improve fruit quality.

Attention is also being paid to indigenous and new overseas pumpkin and squash varieties. Three strains of indigenous pumpkins were selected in Caprivi for high resistance to disease and good quality and keeping quality. Promising results were obtained with the imported squashes Golden Zucchini, Ranger and Kinored.

CABBAGE

Cabbage is the fifth most important type of vegetable with regard to turnover on the 14 national markets of South Africa. The whole industry depends chiefly on a few hybrid cultivars such as Gloria, N.S. Cross, Hercules and a couple of others. All seed of these cultivars is imported from overseas. This situation could create problems in times of crisis.

The Horticultural Research Institute therefore conducted a countrywide evaluation of the best open-pollinated cultivars and advanced breeding strains to determine which other cultivars could be successfully used.

The results showed that, apart from the hybrids, the following cultivars (arranged in order) produced the highest yields at the following stations: Kopenhaagse Mark, Badger 18, Breeding Strain 2 and Special Glory at Roodeplaat; Breeding Strain 2, Badger 18 and Breeding Strain 1 at Addo; Badger 18, All Head and Breeding Strain 1 at Nelspruit and Brunswick, Badger 18 and Breeding Strain 2 at Glen. Yields varied from 40 to 62 tons/ha.

Cabbage for dehydration

Cabbage is specially planted for dehydration in the Transvaal Lowveld. The most important cultivars used for this purpose are the two hybrids Gloria and N.S. Cross. Both cultivars are very susceptible to bacterial black rot, N.S. Cross being especially susceptible. This disease is mainly a secondary one and affects the outer leaves especially badly. Infection is commonest during hot, moist periods.

To determine whether there are not other cultivars available whose adaptation is as good as or better than that of the above cultivars, a trial was carried out during the summer at Nelspruit with 29 cultivars. The following four cultivars showed the least signs of black rot infection: Hercules, Magnum (which closely resembles Gloria) Rotan and KK Cross. Hercules appears to be a find and is now being used by dehydration factories.

CAULIFLOWER

Twenty-three cultivars were evaluated in a statistical trial at Roodeplaat. The old favourite Snowcap, which produced the high yield of 48 tons/ha, again showed that no other cultivar can beat it. Its yield was considerably better than that of all 22 other cultivars in the trial.

The new F_1 hybrid, Snowcrown, also produced very good results. This was the cultivar with the shortest growing season: the harvesting period started 49 days after transplanting and ended at 84 days. In addition it produced a very high yield for an early cultivar (31 tons/ha). The head quality was also fairly good.

ONIONS

The breeding programme aimed at making good parent seed of Caledon Globe and Australian Brown available to the industry was continued at Elsenburg. Four strains of Caledon Globe and one of Australian Brown, which have higher uniformity and better keeping quality than the standard cultivar, are being registered for seed production this year. The seed obtained will be critically evaluated in the various production areas before being released.

Pickling onions: Trials with Early Lockyer White

The production of white onions for the pickling industry is a small but intensive undertaking. These onions are produced by a small number of farmers, on a relatively large scale, the cultivars used being mainly White Pearl, White Creole and Atjar.

It was established in the course of cultivar trials at Roodeplaat in 1977 that the cultivar Early Lockyer White is considerably earlier than any other white cultivar. Seeding time trials were held in 1978, the cultivar being sown in each month of the year. The results obtained showed that seeding during June, July and August produces the most acceptable product.

SWEET POTATOES

Sweet potatoes are marketed from production areas outside the Transvaal Lowveld, chiefly directly from the land, without post-ripening. The keeping qualities and transport potential are poor. The system results in the market easily becoming over-supplied during the relatively short harvesting season. To relieve this problem, storage trials were carried out at Roodeplaat and all the field stations. It was found that a post-ripening treatment of eight days at a

The effect of planting time on onion production: the cultivar Early Lockyear White was sown at Roodeplaat during every month of the year for pickle onion production. The plantings in June, July and August (numbers 6, 7 and 8) produced the best pickle onions

temperature of 30 °C and a relative humidity of 90 % has considerable advantages. The table quality improves and the keeping quality and shelf life are extended to 100 days and more. Elsenburg and Outeniqua were the exceptions, however - there the treatment achieved very little.

Further trials were carried out with the object of extending the storage life more cheaply by wintering adult tubers in the soil. Good results were obtained with most cultivars at Roodeplaat, Nelspruit and Addo. At Nelspruit there was an increase of 11 tons/ha because the plants showed further growth under the relatively warm winter conditions.

MUSKMELONS

The breeding programme at Elsenburg was continued in order to develop a well-adapted cultivar with good keeping and transport qualities that would be acceptable to the European markets.

Breeding strains selected last year were critically evaluated during the year under review. Two made a very good showing, namely:

1. A hard-skinned, white muskmelon suitable for export by sea. This strain has a ribbed skin like Elche and should therefore make an impression overseas. It is not subject to sunburn.

2. A strain with a yellow and white peel, suitable for export by air. The strain is not subject to sunburn and does not appear to be subject to rotting at the point of contact with the soil. The strain is undergoing final improvement.

Eleven cultivars were also evaluated for resistance to powdery mildew in trials at Roodeplaat. Two cultivars, namely Ein Dor and Tam Uvalde, were completely resistant and Edisto and Saticoy fairly tolerant of powdery mildew. Two recognised preparations, pyrazophos and triforine, were used at the normal recommended doses to control powdery mildew. The results show that pyrazophos is far more effective than triforine with all cultivars. No phytotoxic effect was observed in any cultivar.

With regard to downy mildew, no cultivar was resistant, and cultivars differed very little from each other with regard to degree of susceptibility.

GARLIC

A large number of garlic samples from various parts of the country were examined for viruses under the electron microscope. All the samples were found to be infested with a rod-shaped virus. Garlic will clearly have to be purified by means of tissue culture techniques in order to obtain virus-free plant material.

PLANT AND SEED CONTROL

INSPECTION SERVICES

CONTROL OVER THE SEED TRADE

Registration of cleaners and sellers of seed

Registered cleaners and sellers of seed in South Africa now number 79 and 321 respectively, i.e. a total of 400.

Control over the cleaning and sale of seed

A total of 766 distribution points were visited

and 1 635 inspections were carried out in order to check whether the provisions of the Seeds Act were being complied with.

Advertisements for seed in magazines were investigated and 20 advertisers who were advertising seed illegally in that they had failed to register as sellers of seed were traced and cautioned.

Legal proceedings were instituted for eight different types of offence.

Sealing lucerne seed

In all 308 lots of lucerne seed were submitted for approval and sealing in terms of the regulations. Of these, 55 lots were rejected on account of the presence of dodder seed and other weed seeds.

The following quantities of lucerne seed were approved and sealed after germination, physical purity and weed seed content had been checked:

Place where approved	Mass of seed approved and sealed (kg) 1978/79	1977/78
Oudtshoorn/Ladismith	1 154 850	972 750
Upington	47 000	77 550
Johannesburg	23 150	14 750
Total	**1 225 000**	**1 065 050**

The quantity of lucerne seed exported was 378 000 kg.

Legislation

The Plant Improvement Amendment Act, 1979 (Act 10 of 1979), which amended the Plant Improvement Act, 1976 (Act 53 of 1976), was published in the *Government Gazette* on 14 March 1979.

Quantities of seed certified

The accompanying table shows the mass (in kg) of seed certified under the various seed schemes:

Crop group	Basic Seed Scheme	SA Seed Certification Scheme	Export Seed Scheme	OECD Herbage and Oilseeds Scheme	Total
Vegetables	3 108	1 015 204			
Field crops	656 948	22 445 899*	174 806	-	1 193 118
Pastures	5 104	117 496	4 300	28 400	23 135 547
			-	-	122 600
Total 1978/79	**665 160**	**23 578 599**	**179 106**	**28 400**	**24 451 265**
Total 1977/78	**1 113 191**	**26 637 499**	**156 862**	**2 532 187**	**30 439 739**

* Of which 20 552 700 kg was maize seed.

The following table indicates the number of inspections carried out and the total area per crop group inspected:

Crop group	Number of inspections	Total area inspected and approved (ha)
Vegetables	992	1 732
Field crops (excluding maize)	803	11 674
Hybrid maize: white and yellow	1 993	2 620
Pasture crops	48	532
Total: 1978/79	**3 766**	**16 558**
Total: 1977/78	**5 270**	**32 979**

A total of 31 seed merchants and co-operatives and 671 nurserymen participated in the schemes.

SEED POTATO CERTIFICATION

Foundation seed potatoes

Field screening

Stock seed potatoes from the Department's unit at Sabie are multiplied by the Potato Board at its foundation seed potato unit at Lydenburg.

The following varieties and areas were planted:

Variety	Area (ha)
Up-to-date	12,20 (11,50)
BP 1	12,12 (15,50)
Van der Plank	4,30 (4,20)
Late Harvest	0,20 (0,70)
Total	**28,82 (31,90)**

Field inspection of these plantings revealed no infection.

Tuber inspection

The following quantities of foundation seed potatoes were certified:

Variety	Number of units certified (30 kg)
Up-to-date	6 959 (4 938)
BP 1	5 564 (10 104)
Van der Plank	2 082 (2 232)
Late Harvest	126 (180)
Total	**14 731 (17 454)**

"AA" certification

Field screening

A total of 5 610 (5 303) ha was offered for certification, an increase of 307 ha. 362 ha (970) was rejected, chiefly owing to an excessively high virus content.

Tuber inspections

The quantity certified was 655 161 x 30 kg (740 672 x 30 kg). 75 283 x 30 kg (113 793 x 30 kg) was rejected, chiefly for exceeding the tolerances

for nematode and potato tuber moth infestation, and because of infection with *Rhizoctonia solani.*

"A" certification

Field screening

In the "A" area 4 395 ha (4 621 ha) was submitted for inspection; only 145 ha (171 ha) was rejected, chiefly because of infection with viruses and bacterial wilt.

Tuber inspections

The quantity certified was 702 983 x 30 kg (603 152 x 30 kg), and 83 957 x 30 kg (50 859 x 30 kg) was rejectd, chiefly for exceeding the tolerances for nematode and potato tuber moth infestation and because of infection with *Rhizoctonia solani.*

Performance tests

In all 2 094 samples (as against 2 044 samples last year) were planted for purposes of performance testing. The tests give an indication of the efficiency of virus disease control by seed potato producers, whose continued membership of the Scheme depends on the outcome of these tests.

PLANT IMPROVEMENT SCHEMES

The plant improvement schemes in operation at present have no legal status as yet and are administered solely on the basis of voluntary participation. Draft regulations for gravevine and deciduous fruit schemes have already been drawn up in terms of the Plant Improvement Act of 1976.

Vines

Selected Plant Scheme

(a) Parent blocks

(i) Rootstocks

The number of rootstocks that comply with the requirements of the scheme in all respects decreased from 511 875 in 1978 to 285 574 in 1979 and the number of blocks from 112 to 52.

The reduction is the result of rejections for virus diseases, felling of rootstocks and withdrawals from the scheme.

The following number of rootstocks qualified for certification:

Scions: 2 967 500
Cuttings for planting: 1 279 500
Rooted rootstocks: 291 500

(ii) Scions

In co-operation with the nurserymen's association, 209 569 scions of all the most important varieties on 25 properties were inspected and approved. Grafted vines will be available during the winter of 1980.

SA Super Plant Scheme

(a) Parent blocks

(i) Rootstocks

4 943 Jacquez rootstocks were established. The total quantities established to date are -

Richter 99	60 266
101-14	57 296
Jacquez	20 531
Paulsen	7 560
143-B	2 390

The following numbers of rootstocks qualified for certification:

Scions: 1 424 680
Cuttings for planting: 1 160 360
Rooted rootstocks: 270 000

(ii) Scions

No scion material has become available under the Super Plant Scheme so far.

(b) Nursery blocks

The following numbers of rootstocks were issued for establishement in nursery blocks:

Richter 99	350 000
101-14	298 000
Jacquez	40 000
143-B	5 000

Drupes and pomes

Selected Plant Scheme

Draft regulations for this scheme have already been drawn up and will replace the present scheme for the best available material. The data available refer to the old scheme and only one nurseryman participated in the scheme this year.

Super Plant Scheme

(a) Parent blocks

(i) Rootstocks

The following numbers of certified plants were established in 20 parent blocks from material supplied by the SAPIO:

Rootstocks	Established 1978/79	Established earlier
M 793	10 719	4 972
BP 2	2 695	1 916
Marianna	1 810	623
MM 106	649	1 539
Quince A	120	1 043
BP 1	34	none
B 12	23	none
Total	**16 050**	**10 093**

The propagating material obtained from this source will be used as rootstocks in nursery blocks.

(b) Nursery blocks

(i) Rootstocks

Fourteen nurserymen laid out nursery blocks during 1978. The following kinds and numbers of plants were established in nursery blocks:

Pear rootstocks	336 193
Apple rootstocks	189 348
Peaches, apricots and plums	75 750
Total	**601 291**

(ii) Scions

The following kinds and numbers of certified buds were issued by the SAPIO to nurseries that qualify and have the required rootstocks:

Kind	Number of buds
Pears	124 450
Plums	70 450
Apricots	44 100
Prunes	17 200
Apples	17 150
Total	**273 350**

(iii) Super plant trees

The following kinds and numbers of trees were certified as SA super plants during the winter of 1979:

Plums	46 300
Pears	24 414
Prunes	15 140
Apples	11 070
Apricots	2 339
Total	**99 263**

The certification of the first super plant trees may be regarded as a victory in the campaign to provide disease-free, true-to-type deciduous fruit progagating material.

Strawberry Scheme

This scheme is still making a positive contribution to the improvement of yields and quality. Nine nurserymen are participating in this scheme and the following numbers of plants of the various varieties have been certified (figures for the previous year in brackets):

Variety	Number of plants certified	
Selekta	755 400	(890 900)
Tiobelle	597 425	(120 000)
Parfaite	488 400	(914 000)
Tioga	104 325	(172 800)
Earlibelle	none	(45 000)
Total	**1 945 550**	**(2 142 700)**

Cherry Scheme

A total of 9 455 cherry trees were certified during the past season. 14 000 buds and 300 rooted rootstocks were issued to two nurserymen participating in the scheme.

INSPECTION OF FLOWER BULBS INTENDED FOR EXPORT

The area planted and the number of bulbs inspected increased slightly in comparison with the previous year.

Winter bulbs

A total of 13 bulb varieties, which covered 79,95 ha and produced 93 million bulbs, were submitted for inspection. *Ranunculus* and *Ornithogalum* were the most important varieties.

Summer bulbs

A total area of 18,78 ha, on which eight varieties, producing 2,4 million bulbs, were grown, was submitted for inspection and approved.

Chrysanthemum cuttings

There was a tremendous increase in the production of chrysanthemum cuttings for export. Two nurseries were inspected and 55 million cuttings were approved.

NURSERIES

Registration

The following table gives an indication of the distribution, and the total number, of nurseries registered with the Department:

Transvaal	999
Cape Province	769
Natal	352
OFS	82
Total	**2 202**

Three hundred and forty-five of these nurseries are situated in the Witwatersrand area, with 218 nurseries in the Pretoria area.

Inspections

In all 3 060 inspections were carried out at the nurseries. Quarantine was imposed at 98 nurseries on account of the presence of harmful insects and plant diseases.

PEST CONTROL

Bacterial blight survey in vineyards

Three premises where bacterial blight had been present were reinspected and 464 982 adult vines were examined. It was possible to lift quarantine at all three premises.

Control of wart disease in potatoes

A comprehensive survey was carried out in one declared area. Susceptible varieties which had been planted in contravention of the regulations were voluntarily destroyed by the owners.

Embargo on the transportation of banana plants

In order to prevent the spread of burrowing nematode *Radopholus similis,* no person is permitted to transport or allow to be transported any banana propagating material in the Transvaal or Natal without a permit. Twenty-nine permits were issued after soil samples had been found to be free of infestation.

Sisal snout beetle survey

Two surveys were carried out along the border with Swaziland and Mozambique to determine the distribution of the sisal snout beetle. The surveys were carried out with a view to proclaiming the infested areas.

QUALITY CONTROL IN RESPECT OF IMPORTED AND EXPORTED PLANTS, PLANT PRODUCTS AND SEED

Imports

(a) Seed declared under the Seeds Act

The quantities (kg) of seed of the various crop groups imported, and the purposes for which the seed was imported, are indicated in the following table.

Crop group	Imported for normal sales	Imported for experimental purposes	Canning/ processing	Owing to a shortage of seed of suitable varieties	Production of fresh produce for export	Multiplication of seed for export	For immediate re-exporting
Forage grasses	515 231	-	-	-	-	-	-
Forage legumes	426 287	-	-	-	-	-	-
Field crops	2 891 428	2 016	-	6 450	-	-	-
Vegetable crops	700 842	-	2 146 675	-	2 050	9 560	763
Total 1978/79	**4 533 788**	**2 016**	**2 146 675**	**6 450**	**2 050**	**9 560**	**763**
Total 1977/78	**5 494 564**	**4 740**	**591 421**	**2 100**	**3 142**	**14 854**	**-**

The total quantity of seed imported amounted to 6 705 622 kg, which is 594 801 kg more than during the previous year.

A total of 11 231 import inspections were carried out and 1 829 plant import permits were issued.

Exports

The following table indicates the quantities of the various kinds of plants, plant products and apiary products that received phytosanitary certificates for export purposes:

Nature of material exported	Mass or quantity certified (kg, unless otherwise indicated)
Plants and cuttings	58 986 966 units
Flower bulbs, tubers and rhizomes	126 949 940 units
Seed potatoes (SA certified)	21 158 675
Table potatoes	11 604 669
Fresh/frozen vegetables	11 157 399
Deciduous fruit	243 637 003
Citrus and subtropical fruit	174 132 650
Groundnuts	58 139 586
Maize	2 663 482 942
Cut flowers (fresh or dried)	1 970 640
Timber	120 281 m^3
Wheat, tobacco, poultry feed, etc.	440 190 713
Honey and other apiary products	2 123 987
Seed (for propagating)	2 519 423

A total of 20 729 (or 4 786 more than during 1977/78) phytosanitary certificates were issued in respect of these exports.

Two hundred and nineteen international seed analysis certificates, covering 1 197 374 kg of seed, were issued.

QUALITY CONTROL

PLANT INTRODUCTION AND THE STORAGE OF GERM PLASM

All imports and exports of samples of plant propagating material on behalf of researchers in the Department are handled by the Division of Plant and Seed Control. The following table indicates the number of samples handled by the Plant Introduction Officer.

Item	1978/79	1977/78
Number of samples exported for research	5 786	8 701
Number of samples imported for local research	5 101	1 703
Number of samples imported for rust nurseries	15 297	6 504
Total handled	**26 184**	**16 908**

The most important kinds of which material was handled were small grain, maize, rice and fruit.

Three hundred and three new samples were placed in the germ plasm bank for storage.

VARIETY CONTROL

Variety control consists chiefly of -

(a) examining and testing candidate varieties with a view to recognition and inclusion in the varietal list maintained under the Seeds Act, and/or awarding plant breeders' rights under the Plant Breeders' Rights Act, and

(b) checking on the maintenance of varieties -
  (i) of which the names have been included in the varietal list, or
  (ii) in respect of which plant breeders' rights have been awarded.

The purpose of the varietal list is to prevent the sale of the same variety under various names or various varieties under the same name or the sale of inferior varieties, and to provide for the maintenance of varieties.

The following table indicates the kinds, and the number of varieties of each kind, for which applications for inclusion in the varietal list were received, and the varieties included in the list:

Kind	Number of varieties	
	Applications for inclusion	Included in varietal list
Maize	38	16
Sunflowers	17	28
Tomatoes	11	5
Grain sorghum	11	2
Peas	5	3
Cabbage	4	1
Soya-beans	3	4
Onions	2	-
Dwarf beans	2	2
Cucumbers	1	2
Cauliflower	1	1
Watermelon	1	1
Muskmelon	1	1
Gem squashes	1	-
Carrots	1	1
Cattle melon	1	1
Subterranean clover	-	1
Cotton	-	1
Total 1978/79	**100**	**70**
Total 1977/78	**74**	**35**

Plant breeders' rights

South Africa is a member of the International Convention for the Protection of New Plant Varieties, by virtue of which it enjoys a reciprocal relationship with regard to plant breeders' rights with nine other member countries.

The Republic has also concluded direct reciprocal agreements on plant breeders' rights with two other countries, so that plant breeders in 11 foreign countries are now able to register their rights in South Africa to new varieties of the types of plants concerned. South African plant breeders have the same facilities in the countries in question, in addition to the right to register their rights in the Republic as well.

The examination of candidate varieties under the Plant Breeders' Rights Act is essentially similar to the examination for inclusion of a variety in the varietal list and in many cases the two can be dealt with simultaneously.

The table on the next page contains a summary, according to variety, of the number of applications received for plant breeders' rights, together with the number of varieties for which rights were granted, and the total number of varieties for which plant breeders' rights were held on 30 June 1979.

South Africa was represented by officers of the Paris Office at all meetings of the UPOV working groups for ornamentals, vegetable crops, field crops and fruit crops, and on the UPOV Board, technical, legal, administrative and consultative committees. Mr A.J. Cronje, Assistant Director of the Division of Plant and Seed Control, attended meetings of the working groups for fruit and field crops and Mr J.F. van Wyk, the Director of the Division, acted as leader of the South African delegation to the Diplomatic Conference for the revision of the UPOV Convention, which took place in Geneva from 9 to 23 October 1978. South Africa was one of the signatories to the revised convention, together with nine other countries.

International registration of proteas

The Division of Plant and Seed Control was appointed by the International Society for Horticultural Science as the international registering authority for South African genera of the family *Proteaceae*.

Ten South African varieties have already been registered, and inquiries have been received from abroad.

Control of the maintenance of varieties

The Act confers the right to control the maintenance of varieties the names of which appear in the varietal list or in respect of which plant breeders' rights are held. 4 355 samples of 55 kinds were tested for control, the following being the most important (number of samples tested given in brackets):

Potatoes (550), maize (431), grain sorghum (256), tomatoes (222) cotton (200), onions (159), dwarf beans (156).

BREEDERS' PLANT MATERIAL

The purification and maintenance of varieties developed by the Department and certain "open" varieties in order to obtain propagating material of a high genetic quality for use in the production of certified material takes place in co-operation with officers of the various regions and institutes.

Kind	Number of applications received	Number of grants plant breeders' rights	Number of applications being investigated	Total number of varieties for which plant breeders' rights were held at 79.06.30
Roses	16	1	27	13
Chinkerinchee	13		14	
Peaches	2		6	5
Pears	1		2	
Grapes	1		1	
Apples	1			
Dwarf beans	1		1	3
Peas		3		3
Beetroot				1
Lupins				2
Maize				6
Soya-beans			2	2
Tomatoes				6
Triticale				1
Aloes				1
Hops				1
Nectarines			2	3
Proteas				5
Plums				1
Groundnuts				1
Cotton			2	
Lucerne			2	
Sunflowers			1	
Apples			3	
Apricots			1	
Total 1978/79	**35**	**4**	**64**	**54**
Total 1977/78	**29**	**47**	**52**	**50**

The following table shows the kinds, number of varieties and quantities of breeders' seed produced and issued:

Kind	Number of varieties	Quantity produced (kg)	Quantity issued (kg) under the Seed Certification Scheme
Vegetable crops			
Beetroot	1	34	-
Cauliflower	1	1,7	-
Beans	5	7 842,3	7 339,3
Peas	2	397	200
Cabbage	1	3,9	-
Pumpkins	1	127	-
Gem squashes	1	99	-
Tomatoes	3	28,7	2,1
Onions	6	47,2	2
Carrots	2	19,1	-
Field crops			
Dry beans	7	9 132,9	9 132,9
Lupins	3	180 379	180 379
Cattle melon	2	16,6	16,6
Soya-beans	4	37 032	37 032
Pasture crops			
Rye grass	1	1 175	350
Rough cocksfoot	1	46	-

THE ANALYSIS, EXAMINATION AND TESTING OF SEED

The Division of Plant and Seed Control renders an invaluable service in connection with control over the seed trade, seed certification, seed exporting, seed imports and seed research in that its seed testing station tests, analyses and examines seed samples for purity, germination, moisture content, weed content and other properties relating to seed quality.

The table on the next page shows the total number of seed samples of field crop, horticultural and forest tree species received by the Division for various purposes:

Most of the samples received were of the following crops: maize, grasses, beans, onions, cabbage, pumpkins, gem squashes, tomatoes, grain sorghum, sunflowers and lucerne.

International activities

South Africa maintained its membership of

Seed group	Private	Purposes In terms of the Seeds Act: Seed Certification Scheme	Trade checks	Export seed	Import seed	Research	Total
Field crops	4 515	3 296	1 550	-	276	455	10 092
Horticulture	5 990	817	982	-	804	116	8 709
Forestry	-	-	-	-	-	180	180
Total 78/79	**10 505**	**4 113**	**2 532**	**-**	**1 080**	**751**	**18 951**
Total 77/78	**9 612**	**4 517**	**2 737**	**403**	**1 117**	**585**	**18 971**

the OECD Herbage and Oilseeds and Vegetable Seed Schemes. The 1979 meeting of representatives of certification authorities under the OECD seed schemes took place in Paris from 9 to 11 May 1979. South Africa was represented by Mr L.J. Grobler, Assistent Director of the Division of Plant and Seed Control.

The Republic continued to be a member of the International Seed Testing Association. Mr J.F. van Wyk, the Director of the Division of Plant and Seed Control, attended the interconvention meeting of the Association in Zurich from 26 to 29 June 1979.

The following officers of the Division of Plant and Seed Control serve on committees of the Association:

Mr J.F. van Wyk
Executive Committee
Rules Committee

Seed Moisture and Storage Committee (in the capacity of Chairman)
Flower Seed Committee

Miss E. Robert
Seed Purity Committee

III. Animal production improvement

RESEARCH

BEEF CATTLE

Where dual-purpose and British beef breed cows were run at **Cedara** on kikuyu pastures at stocking rates of 4,2 and 6,7 cows with calves per ha, the weaning masses of the calves were 209 kg and 177 kg respectively and the live mass production 720 and 570 kg per ha for the lower and higher stocking rates.

Supplementation with a winter lick containing urea (as against a dicalcium phosphate lick) for lactating cows on highland sourveld in **Natal** at the stocking rate treatments of 1,0 and 1,67 LSU/ha had a significantly favourable effect on mass increase.

Eragrostis curvula which had been cut for hay and had rained wet was ensiled without any further additions. The silage was compared with *E. curvula* hay for the overwintering weaner heifers at the **Thabamhlope Research Station**.

During the first year of the trial the heifers lost 6,47 kg of live mass on the silage over a period of 110 days, as against a mass increase of 22,8 kg on the hay. During the second year the heifers lost 10,8 kg on the silage over a period of 78 days, as against a mass increase of 24,7 kg on the hay.

An average daily increase of 0,67 kg was obtained by replacing half the silage with hay.

The computer simulation model, NSBFT, which was very successfully used in beef cattle production systems in Natal, recently underwent further refinement with the development of more realistic formulas for the prediction of voluntary feed intake, digestible crude protein requirements and carcase price.

A haemolytic test for the blood-typing of cattle

An improved method of cost estimation was also built into the model and the data norms were considerably simplified.

At the **Animal and Dairy Science Research Institute** investigations are being conducted into the value and the roughage properties, as they are known, of certain types of roughage, and especially into the ability of roughage to maintain a healthy rumen environment in high concentrate rations for beef cattle. The desirable level of inclusion of each type of roughage in the finishing rations was also quantified in the investigation. The optimum levels of inclusion were as follows:

Sunflower hulls - 10 %, bagasse pellets 25 % and *Eragrostis curvula* hay - 20-25 %. It was interesting to observe that the optimum level of inclusion changed with the size of the screen used for milling the hay. When a 51 mm screen was used the desirable level of inclusion was 15 %, whereas 35 % had to be included when a 6,4 mm screen was used.

One of the most important reasons why concentrate supplementation is frequently unsuccessful from the financial point of view is that the digestion of roughage in the rumen is occasionally suppressed by the organisms that digest concentrates, with the result that roughage is frequently not well utilised and the intake drops.

There is a possibility that the adverse effect on roughage digestion could be counteracted by changing the form of the concentrate, in this case the maize kernel. Four forms of the maize kernel were used in the investigation, namely whole kernels, whole kernels treated with caustic soda, which breaks the outer skin of the kernel, crushed maize and meal.

The results showed that roughage intake (*Eragrostis curvula*) decreased in direct proportion to the increased level of supplementation and that there was no difference between the various forms of maize.

The digestibility of the roughage was approximately 55 %, that of the whole kernel maize 60 %, the caustic soda-treated whole kernels 82 %, the crushed maize 72 % and the maize meal 88 % on the dry basis. The intake of digestible material rose in direct proportion to the level of supplementation so that the highest intake and growth and the best feed conversion were obtained at the highest level of supplementation. It was evident that the group fed on meal grew best and maintained the best feed conversion.

An investigation into the effect of phosphorus supplementation on the performance of beef breed cows on veld grazing at **Armoedsvlakte** and **Glen** has so far shown that phosphorus supplementation, particularly at Armoedsvlakte, is beneficial to the body mass, voluntary feed intake and bone phosphorus status of lactating cows.

According to previous experimental results in the **Highveld Region** maize silage containing about 40 per cent grain (dry basis) provided sufficient energy but too little protein to finish cattle effectively. It has now been found that the inclusion of 11,5 per cent crude protein (dry basis) in both silage and concentrate rations is sufficient to round off eighteen-month-old oxen successfully.

Experimental work during previous seasons has shown that at **Potchefstroom** fertilising the veld can boost the large stock stocking rate by 100 %-150 % during summer and autumn and increase veal production by 113 %-163 % without harming either the veld or the animals in any way.

During the year under review Merino ewes with lambs were included in the study with Simmentaler cows and calves in a sheep:cattle ratio of 5:1. Fertilising boosted the stocking rate by 160 %, the mass increases of the calves by 10 %, the mass increases of the lambs by 18 % and the mass increases per ha (calves plus lambs) by 164 % of the figures for unfertilised veld.

At **Soutpan**, a demonstration farm for extensive cattle farming, the proven success of optimum veld utilisation and effective herd management has now been determined in monetary terms as well. At present a gradual switch is taking place to an ox system with a marketing age of 30 months. The manipulation of the market, e.g. by preparing animals for December slaughtering, when prices are considerably higher than during the rest of the year, is also being investigated.

Lucerne and eragrostis silage, ensiled by the vacuum method, were tested at the **Nooitgedacht Research Station** as winter feeds and compared with lucerne and eragrostis hay. The average mass increases over a period of 84 days were -4, +13, +21 and +26 kg for eragrostis silage, lucerne silage, eragrostis hay and lucerne hay respectively. The high moisture percentage of the silages may have had a limiting effect on dry matter intake.

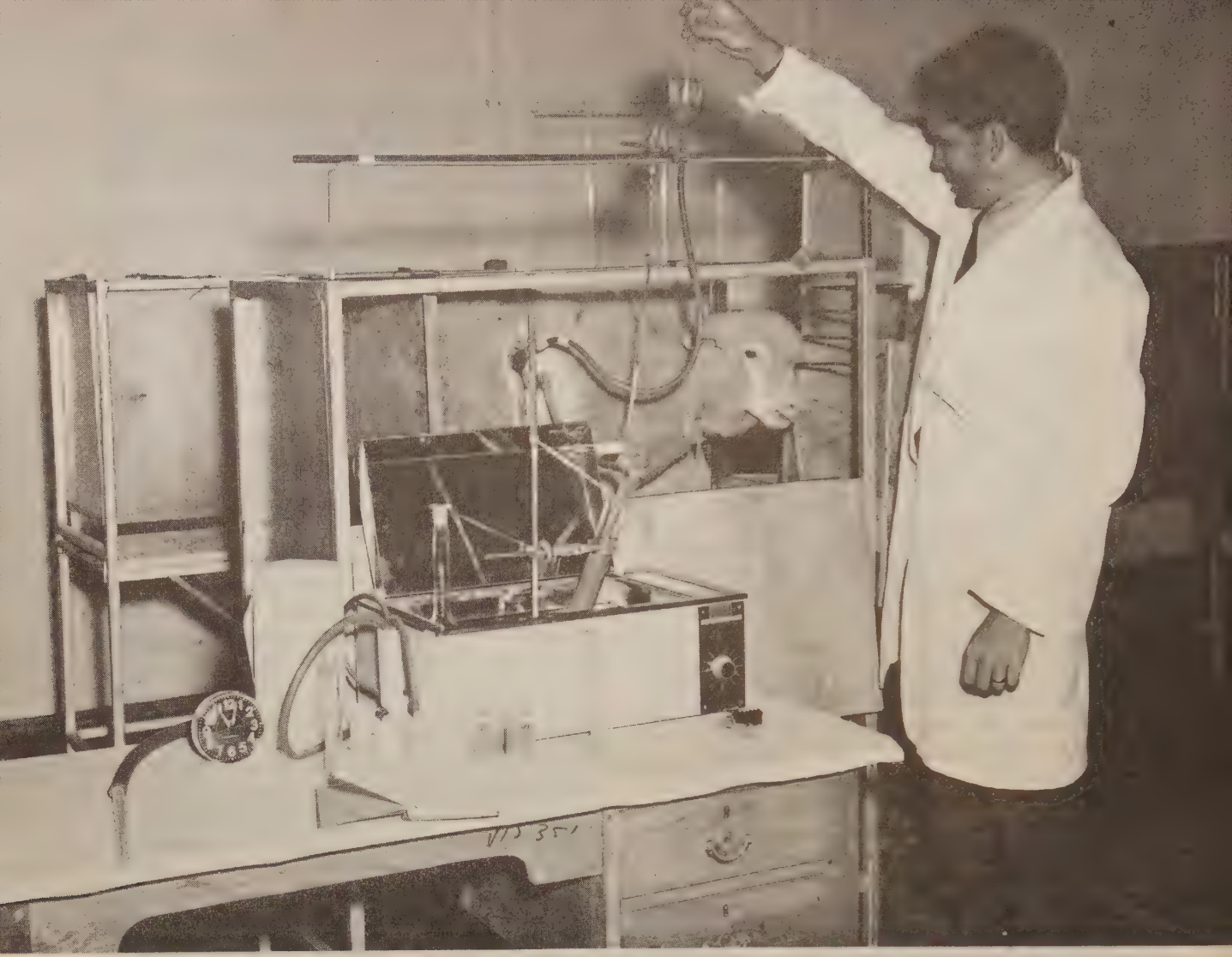
The average conception percentage at the **Athole** semi-intensive unit over eight years was 91,2 per cent and the average conception percentage in heifers calving for the first time was 100 per cent.

Another achievement for Athole was a calving intensity of 92 per cent within the first 25 days of the calving season. The calves were weaned at an average mass of 234 kg at 240 days.

MUTTON SHEEP AND GOATS

An investigation into the carcase composition of the lambs of four sheep breeds and of the Boer goat is being carried out at the **Animal and Dairy Science Research Institute** at Irene. The quantities of muscle and fat are important in that they determine the meat yield of a carcase; distribution is also important since it determines what the proportion of "expensive" to "cheap" meat in the carcase will be.

It was found that at comparable dressing masses between 10 and 41 kg of live mass the proportion of muscle in the forequarters to that in the hindquarters is higher in Boer goats than in sheep.



Studies on the utilisation of non-protein nitrogen are done by providing animals with re-entrant duodenal cannulae

The sheep breeds studied were the Merino, the South African Mutton Merino, the Dorper and the indigenous breed from the Northern Transvaal, namely the Pedi.

The last two types, which were fatter throughout than the two Merino types, had proportionally more muscle in the cheaper brisket than in the hindquarter than did the Merino types, especially at the higher dressed masses.

As in the case of the muscle distribution in the carcase, important fat distribution patterns were also established. It was clear that considerably less of the Boer goat's muscle and fat is found in the expensive buttock meat than is the case with sheep.

Subcutaneous or superficial carcase fat is the fat depot of the carcase, which is evaluated when the carcase is marketed in order to determine market readiness. An optimum amount is necessary to protect the carcase against drying out and make the meat more flavoursome. However, excess subcutaneous fat is trimmed off by the consumer before the meat is eaten and is therefore a drawback. Knowledge of the optimum slaughtering stage with regard to carcase fat in slaughter stock is of great economic importance in lamb and mutton production.

Good progress was made in the **Karoo Region** with the development of a white-woolled mutton sheep for the extensive Karoo sheep pasture areas. The stage has now been reached where farmers can be involved in the further development of the breed.

Notwithstanding the severe drought of the past year the new breed has done very well and has shown a relatively high breeding capacity, namely 70 %. The body masses of ram and ewe lambs at twelve months were 38,8 kg and 34,4 kg, respectively.

In trials at **Cedara** in which the promotion of increased mutton production under intensive conditions was studied, researchers were able to achieve three lambing seasons within the space of two seasons.

The dry grass/bush communities comprise about 2,0 million ha or 40 % of the natural pastures of the **Eastern Cape Region**. The ecology of these marginal rainfall areas has been disturbed by (i) overgrazing, (ii) inadequate veld management systems and (iii) the absence of the browser as a

component of the stock-farming system.

Instead of bush removal at a high cost (R30/ha), an adapted livestock production system was introduced at **Adelaide**. It comprised the following:

(i) A new approach to the multiple utilisation of various types of vegetation.

(ii) The inclusion of the Boer goat as a full component of the stock-farming system, together with beef cattle.

In the light of the following production data, this system would appear to be very promising for similar livestock production systems in an area comprising almost 40 million ha of pastures in the Republic.

	1976/77	1977/78	1978/79
Boer goats			
Ewes lambed (%)	97	99	100
Lambs born (%)	177	191	151
Lambs weaned (%)	143	184	105
Weaning mass (kg)	29,8	28,2	28,0
Mass of young ewes - 18 months (kg)	53	50	-
Beef cattle			
Calves born (%)	86	94	91
Weaning mass (kg)	254	262	271
Adapted weaning mass (kg) (210 days)	232	238	257
Mass of cows at weaning	498	519	554

The overwintering of sheep in the **Highveld Region** remains one of the basic problems for the researcher in his attempts to work out a flow programme for the provision of feed over a period of a year. Research is consequently geared to the evaluation of locally available sources of roughage as feeds for full-grown sheep and slaughter lambs.

The evaluation of dry roughage feeds is virtually complete and special attention is being given to *silage* and *annual soilage feeds* for use in slaughter lamb production.

Silage for slaughter lamb production

Previous results have shown the lambs can be successfully finished on 70 per cent maize silage and 30 per cent concentrates, provided that the crude protein content of the total ration (silage plus concentrates) is 14 per cent.

In a follow-up study it was found that, when used as a nitrogen supplement to maize meal rations or maize silage (with a normal grain content) upon ensiling, natural sources of protein, such as fish-meal, produce a significant increase in the growth rate in comparison with Starea and urea as the nitrogen supplement.

It was also found that from 17 kg (weaning mass) to 30 kg of live mass the total protein content of the ration should be 14%.

Maize meal supplementation to maize silage fed *ad lib.* should be 1% of the body mass per day.

Annual winter soilage crops in slaughter lamb production

At the **Bethlehem Research Station** soilages that included oats, rye, ryecorn, wheat and rye-grass cultivars were compared with a control ration consisting of equal parts of lucerne and maize meal.

The lambs (South African Mutton Merino) that received the lucerne and maize meal mixture grew most rapidly, but the cost was highest and this ration was the least profitable.

The various soilages, particularly ryecorn, all provided cheaper finishing rations and yielded a far higher profit than the control ration.

In the Eastern Free State winter soilage therefore holds great potential for boosting mutton production per unit area.

PIGS

Nutrition

A digestibility study with pigs was conducted at the **Animal and Dairy Science Research Institute** to determine the effect of formaldehyde treatment on the protein and energy digestibility of bird-proof grain sorghum.

Formaldehyde treatment increased protein digestibility from 57% to 73%, and the protein ingested by the pigs was better utilised in that the efficiency of utilisation rose from 21% to 27%. Energy digestibility was also improved, but only slightly.

A long-term study in which weaning at three weeks was compared with conventional weaning at five weeks has recently been concluded.

The reproduction cycles of the early-weaned sows were reduced by 14,1 days on average, which resulted in these sows producing 2,52 litters a year, as against 2,30 for the group weaned at five weeks. In addition sows in the group that was weaned early reared 2,6 more piglets a year (22,16 as against 19,52).

Low-cost pig rations

A number of supplementary computer programmes were developed at **Cedara** in order to simplify the use of linear programmes for the calculation of low-cost pig rations. One of these programmes prepares the input data required for the linear programme, and another programme makes outputs from the linear programme available in an easily understandable form.

The linear programme has already been used to compose low-cost rations for farmers.

The determination of C + K measurements in pigs

The determination of the protein quality of protein sources by means of biological testing

POULTRY

Poultry performance testing

Egg production tests

At the conclusion of the thirteenth random sample egg production test at **Glen** a hen-housed average of 248,65 eggs per hen was obtained, and the figure for the eighth test at Irene was a hen-housed average of 240,79 eggs per hen up to an age of 504 days.

These tests are not only useful in evaluating local breeding material but also provide a valuable means of evaluating overseas material with a view to the possible importing of breeding stock.

During the year under review only one firm imported broiler breeding material. Since permission to import poultry was granted in 1972, 151 785 head of poultry breeding material have been imported, 5 219 of which were donated to the State.

To date 15 612 dozen fertilised eggs and 1 443 birds derived from donation to the State have been sold to farmers.

MEAT SCIENCE

Refrigeration of carcases

In order to determine what factors play a part in the loss of mass during the refrigeration of recently flayed beef carcases, a comprehensive investigation was undertaken a few year ago by the **Animal and Dairy Science Research Institute** and the **Veterinary Research Institute**, in co-operation with the CSIR.

It was found that the humidity and air velocity in the cold-room do not have a notable effect on the loss of mass during the prechilling period (usually one or two days).

The two carcase factors that have an important influence are the mass and the fatness of the carcase. Larger and fatter carcases show a lower percentage mass loss than smaller and leaner carcases.

A second, very important aspect that emerged from this work is the potentially harmful effect of rapid chilling of carcases on the eatability of the meat. By legislation, in South Africa carcases have to reach a temperature of no higher than 7 °C in

The quality determination of eggs

the deepest part of the carcase before the meat may be removed from the abattoir. If this temperature has to be reached within a relatively short period of chilling, rapid chilling methods are used, with the result that the muscle temperature may drop to 10 °C and below within 10 hours of slaughtering, which produces cold shortening and toughening of the meat. This is especially noticable in the back muscles and certain muscles of the buttock.

The back muscles represent 20 % of the meat yield and 31 % of the monetary value of a carcase and if they are tough the consumer gains a very negative impression of the eatability of the meat.

Such toughening can, however, be prevented if the muscle glycogen content is reduced directly after slaughtering to the point where muscle contraction can no longer take place when a muscle temperature of below 10 °C is reached.

In order to reduce muscle glycogen rapidly after slaughtering, a 500 volt electric current is passed through the carcases at a frequency of 12,5 herz for 60 seconds. This treatment was found to produce a difference of 50 % in the toughness of electrically stimulated and non-stimulated carcases after rapid chilling.

The meat of non-stimulated carcases was found, both on evaluation by a panel of tasters and after the physical measurement of toughness, to be unacceptably tough whereas the stimulated carcases were found to be acceptably tender.

This technique could be very usefully applied in the South African meat industry to achieve optimum eatability.

A further method of preventing cold shortening in muscles which was investigated was the chilling of carcases at higher air temperatures.

Carcase grading

The **Animal and Dairy Science Research Institute** has been engaged during the past four years in evaluating the current beef grading system in South Africa. A sample of a few thousand carcases, representative of all grades, was selected and several determinations in respect of carcase fatness, mass and conformation were carried out on each carcase in order to determine grade characteristics.

The eatability of the meat was also determined according to physical, chemical and organoleptic characteristics in order to determine whether the carcase grade and age of the animal play a part in determining eatability.

Carcases of the higher grades (Super, Prime and I) had more removable fat than carcases of the lower grades (II and III), and the differences found among the three higher grades were smaller than the differences between the three higher grades on the one hand and the two lower grades on the other hand. The fatter carcases also produced a lower yield of deboned, saleable meat and even had less meat in the more expensive carcase cuts.

The eatability of the meat is affected not so much by the grade as by the age of the cattle. Meat from animals with a maximum of two permanent incisors is notably more tender (18 %) than that from older animals.

The two carcase characteristics that are judged in order to determine cutability are market readiness (external fat cover) and fleshing (external conformation or fullness). These ought to provide an indication of the edible yield of the carcase.

Graders are successfully able to judge fatness on the basis of the visible market readiness. However, the values obtained in the judging of fleshing bear no relation to the meat yield of the carcase.

It therefore appears from these results that the fatness and the age of an animal are the two most important factors in determining the meat yield and the eatability of the meat.

WOOLLED SHEEP

In the course of an investigation in the **Karoo Region** into the elimination of quality defects in Merino wool it was found the deliberate selection for good quality, with over-emphasis on softness of feel, produces a higher degree of undercrimping, a characteristic with decided disadvantages.

Research also showed that a large percentage of the Merino wool clip in the Karoo farming areas is badly and deeply weathered. Producers are advised to provide sufficient shade in grazing camps and to arrange shearing times, if possible, in such a way that the wool is not allowed to grow too long during the summer months.

With kikuyu, Rhodes grass, *Eragrostis curvula* and lucerne pastures as the basis, the following production figures were obtained with Dohne Merino ewes in the **Eastern Cape** during the first three successive reproduction cycles of eight months each:

Characteristics	Cycles (of 8 months each)		
	1	2	3
Ewes lambed (%)	88	80	87
Lambing percentage	140	115	125
Meat production/ha (kg)	120	92	108
Wool production/ha (kg)	22	21	20
Gross margin/ewe	R5,60	R13,05	R2,10 (-)

At the **Nooitgedacht Research Station** green kikuyu grazing was studied as a finishing ration for old ewes. Maize meal was provided as supplementation. The profit was R1,23 per ewe higher than the profit on the controls. Green kikuyu grazing therefore has decided economic advantages over the conventional finishing ration.

The finishing of lambs on rations containing various levels (10 %, 40 %, 70 % en 100 %) of lucerne as roughage was also investigated at Nooitgedacht.

The group on 40 % lucerne did best and attained a live slaughter mass of 56,6 kg, as against 35,0 kg for the group (of the same age) on 100 % lucerne.

Lambs on 70 % lucerne also did well, whereas those on 10 % lucerne showed surprisingly poor growth when the quality of the ration is taken into account.

When various levels of *E. curvula* hay were included in the finishing rations for old, culled ewes it was found that eragrostis hay can be used to good effect. A profit over feed costs of R2,00 per ewe was obtained.

At the **Athole Research Station** an average inter-lambing period of 270 days and ten lambing seasons during the 6½-year period from May 1972 to December 1978 were obtained on the semi-intensive unit. The average lambing percentage was 79,3 %, with an average corrected weaning mass of 23 kg.

PELT SHEEP

Good progress is still being made with the breeding of grey and white pelts. The dominant white at the **Kalahari Research Station** is very important here.

A histological investigation into ante-natal pelt development in four Karakul lines (pipe curl, developed shallow curl, shallow curl and watersilk) undertaken at the Animal and Dairy Science Research Institute at Irene has been concluded. A survey was made of pelt and follicle characters in order to try to identify possible differences between the four types.

The pipe curl line shows the thickest skin and the deepest and most oblique follicles of the four types. Deviations from the normal round or elliptical shape were also observed in the pipe curl line, where some of the fibres have an uneven appearance.

Progress with selection for four important pelt characters is being measured in a comprehensive breeding trial with Karakul sheep in the **Free State Region**. The percentage progress in the fourth generation (the control) was as follows for the four characters: Curl type - 58 %; hair length - 28 %; pattern - 25 % and hair quality - 25 %. Progress has been made with selection for twins: a figure of 10 % has been attained, as against 4 % in the control group.

The project aimed at developing a chocolate brown Karakul pelt with light golden or silver hair tips has made good progress. It is clear at this stage that the light tips, which are highly heritable, are the most important factor in determining the value of the pelts. It has also been found that mating chocolate brown animals produces a progeny in which 50 % tot 60 % are also chocolate brown.

An investigation into the nutritional value of Orange River broken veld (hard veld) and Kalahari duneveld (soft veld) has produced very interesting results. Both veld types are able to satisfy the nutritional requirements of dry ewes in respect of crude protein and engergy.

ANGORA GOATS

Research has been carried out in the **Karoo Region** on the effect on Angora goats of the level of energy and protein nutrition in respect of perinatal losses, lactation and the growth of kids.

Various levels of energy nutrition affected the average daily milk production during the lactation period very significantly. The effect of various levels of protein nutrition on the average daily milk production increased during the lactation period. Within six hours of birth there were notable differences in the colostrum production of goat ewes in the various experimental groups.

The proportions in which the various milk components occurred were considerably more affected by the various energy levels than by the protein levels. Kids born to experimental ewes kept on low protein and/or energy nutrition were more inclined to weigh under 2 kg.

A six and eight week fattening programme for Angora goats produced more or less the same results as in the case of Merino sheep. As in the case of the sheep, six weeks of fattening was more profitable than eight weeks, but the results show that the fattening of Angora goats is uneconomic.

Reproduction studies were directed at the endocrinological mechanisms that cause abortion in Angora goats. Pregnant Angora ewes were treated with synthetic prostaglandin and regular blood specimens were taken for the determination of progesterone. All the treated animals aborted. Circulatory progesterone showed a marked decrease within four hours of treatment.

DAIRY CATTLE

Nutrition

Despite the high feed production potential of the **Highveld Region** (about 42 per cent of the Republic's dairy products and fresh milk is produced in this Region), a great deal can still be done to improve the average lactation production of 1 500 kg per cow and the general profitability.

The matters being investigated at present include the utilisation of artificial pastures, the development of a suitable complete diet which could save a great deal of labour and the efficient rearing of calves.

Preliminary data at the **Bethlehem Research Station** indicate that with the correct forage cultivars, fertilising, planting time and methods of moisture conservation the feed costs per kg of milk could be reduced to less than the cost of a conventional balanced ration.

Preliminary results indicate that the inclusion of sheep manure (20 % to 30 %) in the concentrate mixture for dairy cows could restrict the voluntary intake of concentrates to an ideal level.

The optimisation of the soya meal, whey powder and colostrum contents of milk surrogates for rearing dairy calves is being investigated at the

Potchefstroom College of Agriculture at present. Preliminary results indicate that a reduction in the mass increase occurs when the whey powder levels exceed 50 per cent of the ration, but that various soya meal levels (10 to 20 per cent) have no effect.

The practice of basing energy supplementation for dairy cows on dry matter intake and the concentration of energy in the ration is being very successfully applied in the Natal Region.

Management

The computer programme DAISI, which was developed by **Cedara** and is still undergoing improvement, is an important aid in the planning and management of several Natal dairy farms. This programme was also used in the Winter Rainfall Region in 1978.

MILK

A survey was conducted to establish the insecticide content of South African dairy products. None of the samples exceeded the DDT international maximum residue limits. However, the quantities of BHC found exceeded the international standard in 67% of the samples, as did the quantities of dieldrin in 32% of the samples. The presence of dieldrin in milk is most likely the result of misuse of the pesticide.

Ultra high temperature (UHT) milk production has been introduced by 4 processing plants, but difficulties experienced at these plants required assistance from the Institute. A pilot UHT plant has been made at the Institute to test:

- survival of thermophilic organisms,
- survival of enzymes secreted by psychrotrophic bacteria during raw milk storage, and
- the effects of the above-mentioned factors on protein breakdown and the keeping quality of this product.

CHEESE

Mould growth on cheese should be regarded as not only an economic problem but also a potential health hazard. The treatment of the cheese surface with plastic emulsions containing antifungal substances merely delays mould growth. At the present time there is no evidence that mycotoxins produced by penicillia in mould-ripened cheese, such as blue-veined or Camembert cheese, present a health hazard to the consumer.

Attempts are being made to produce a low-fat cheese which has an acceptable flavour, but which provides relatively few kilojoules. So far the main difficulty has been to achieve an acceptable flavour; an acceptable texture has already been successfully produced. The use of special bacterial cultures for flavour development is now being investigated.

Whey utilisation

With a cheese production of 28 000 tons per annum in South Africa an almost equivalent quantity of milk solids is being either underutilised or wasted. Research has been carried out on a wide field of possible products from whey for commercial use.

The preparation of magou by using cheese whey, whey powder or whey protein concentrate is being investigated. This not only increases the nutritional value of magou but produces a more palatable product, and provides a further means of utilising whey.

Attention was also paid to the development of dairy products containing whey instead of milk as the main ingredient. A whey-kefir and a chocolate whey drink were successfully developed. These products have a high nutritional value and a pleasant and refreshing flavour and can be prepared more cheaply than yoghurt.

This research gave rise to a successful symposium on whey utilisation at the Animal and Dairy Science Research Institute, in which several overseas visitors participated.

The manufacture of high protein whey powder by means of ultrafiltration:

In this process the protein content can be adjusted to consumer requirements (30-90%), depending on demand. Various applications of this whey powder, from ice cream manufacture to the manufacture of infant foods have been investigated. Various methods of composition control have been successfully tested for practical application in the industry.

BUTTER

Because of the diet consciousness of the consumer, work has been carried out on the production of a low-fat spread and a low-fat cheese.

These products are receiving increased attention in overseas countries, but because most of the manufacturing procedures have been patented, research is necessary before these products can be manufactured locally.

A low-fat spread which will be spreadable at refrigeration temperatures and will be able to compete with margarine on the consumer market is being developed. The new product is intended to have half the fat content of ordinary butter and a 20% higher protein content. These products have been consumer tested and have been favourably received.

DAIRY AUXILIARY SERVICES

Quality improvement laboratory

During the past year quality determinations were carried out on butter, cheese, milk powder, pasteurised milk, yoghurt, cottage cheese and ice-cream. Over 3 000 analyses were also carried out for the Dairy Control Board with a view to the possibility of importing butter and cheese.

The average values for the various tests on butter were generally better than the previous year. Undesirable coliform organisms do, however, occur in a large number of samples.

The pH and acid values, percentage salts and results of organoleptic judging were very good and complied with the Class I standards of the Animal and Dairy Science Research Institute.

Sixty samples of milk powder were analysed. The results are indicative of good quality control at the factories that submitted the samples.

At the milk testing laboratory at **Elsenburg** milk tests were carried out for 13 000 cows for the Winter Rainfall Region - an increase of 1 000 over the figure for the previous year. The analytical methods were refined, the various pieces of infra-red analytical apparatus throughout the country were checked and working methods were standardised.

SUPPORTING RESEARCH

Feed evaluation

Research at the **Animal and Dairy Science Research Institute** showed that the voluntary intake by sheep of kikuyu grazing is undoubtedly lower than is normally the case with other types of grazing of similar quality. This finding bears out observations by farmers that stock sometimes fail to thrive on kikuyu pastures.

No satisfactory explanation for this phenomenon has been found as yet.

Feed improvement

Research on the chemical improvement of low-grade roughage has been unable to show any adverse effect on animals that is related to the use of straw treated with caustic soda. However, caustic soda treatment is frequently less successful in practice because the directions for treatment are not all carefully observed. The use of chemicals other than caustic soda for this purpose was also investigated.

Feed flow planning

The **Natal Region** is making good progress with the development of computerised programmes for the planning of livestock production enterprises, especially with regard to the problem of feed supply. The programmes already in use have greatly simplified the planning and implementation of feed production strategies and several farms are already involved.

A specialist extension officer was specially appointed to carry out feed flow planning and promote the use of the computer for this purpose. The aim is to introduce an automatised procedure according to which a farm can be planned or replanned within a day after the basic surveys have been carried out.

LIVESTOCK AND PASTORAL PRODUCTS IMPROVEMENT SCHEMES

NATIONAL BEEF CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

Interest in performance testing as an aid in selection has reached a new peak, particularly in the stud industry. Three breed societies have already made performance testing compulsory for all their members and other breed societies may possibly follows.

As Table 1 shows, the membership increased by only six during the past year, but there was a decrease in commercial producers and a satisfactory increase in stud breeders.

The number of mass determinations increased by 10 730, notwithstanding the drought in certain areas, where breeders even had to move their stock and no masses were determined.

As Table 2 shows, the number of bulls subjected to growth tests increased by 141 during the past year.

Twelve progeny groups were subjected to carcase evaluation during the past year. The edible meat yield, carcase value and meat quality are being intensively studied.

PERFORMANCE TESTING OF WOOLLED SHEEP

The steady increase over the past few years of about 3 000 wool samples in the number of samples analysed *per annum* at the **Fleece Testing Centre** continued. In all 26 061 samples were analysed, an improvement of 2 976 on the record number of the previous year.

Performance testing of woolled sheep has become a firmly established practice. This may be ascribed mainly to sustained extension work. A total of 844 breeders and officers have so far attended the short courses held by the Fleece Testing Centre.

A computer programme for processing performance data has been developed. Because the crimp:fibre thickness ratio is such an important

TABLE 1 - Number of members and masses recorded

Region	Members		Masses recorded	
	1977/78	1978/79	1977/78	1978/79
Transvaal	407	340	86 837	91 849
Natal	200	204	60 320	55 545
South-West Africa	147	151	48 069	51 754
Northern Cape	161	195	44 722	49 421
Eastern Cape	150	151	33 349	32 496
Free State	79	107	14 363	16 359
Western Cape	16	18	1 391	2 357
	1 160	**1 166**	**289 051**	**299 781**

TABLE 2 - Number of bulls subjected to growth tests

Centre	Bulls tested	
	1977	1978
1. Departmental centres:		
Irene	266	233
Vryburg	272	263
Queenstown	133	159
Cedara	33	149
Omatjenne (SWA/Namibia)	35	18
2. Non-Departmental centre:		
Potgietersrus	55	117
3. Tests carried out on farms:		
Republic	1 538	1 562
SWA/Namibia	186	158
Total	**2 518**	**2 659**

quality characteristic of apparel wool, it is also calculated. The programme also makes provision for corrections for birth status and the age of the mother, and for the calculation of a selection index. A complete progeny test on the rams in regular use is also provided. In general this development met with considerable approval from breeders.

NATIONAL MUTTON SHEEP PERFORMANCE AND PROGENY TESTING SCHEME

The demand for this service increased by 28 %. Growth determinations were carried out on 7 453 ram lambs and 7 908 ewe lambs from 134 breeders.

As a result of scientific selection on the basis of this scheme the number of slaughterings from the same number of breeding stock increased by about 30 %.

NATIONAL PIG PERFORMANCE AND PROGENY TESTING SCHEME

Pig recording and health phase

At the end of the year there were 46 active members, ten fewer than the previous year. The reduction in the number of active members may be ascribed largely to the considerable increase in the feed prices, which prompted many small breeders to leave the industry.

Performance testing (boars and sows)

Despite the drop in the membership, 1 238 boars were tested, which is 5 % more than the previous year. The demand for boar testing at **Elsenburg** is so keen that no gilts are being accepted for testing. Moreover, 50 % of the applications for the testing of boars had to be refused owing to a lack of testing facilities.

Irene has twice the capacity of Elsenburg, but tested fewer boars. This is because progeny testing is centred at Irene, where all the progeny groups have to be housed.

The lowest average feed conversion (2,72) was obtained at **Irene** and the highest (2,90) at Cedara. Irene and Cedara had the same average C + K (39 mm), but the figure for Elsenburg was very low (30 mm), i.e. the Western Cape has Landrace and Large White strains, which are very thin.

Halothane testing

The Pig Testing Advisory Committee decided that all piglets that arrive at the testing centres for performance or progeny testing should be tested for sensitivity to stress with the aid of halothane gas. If a positive reaction is obtained the pigs in question should be slaughtered.

Sensitivity to stress among South African pig herds is a cause for concern because stress-sensitive pigs soon die when exposed to any form of stress. Stress-sensitive pigs also produce poor quality meat known as PSE (pale, soft and exudative), which could have a very bad effect on the industry.

The results revealed major differences - 12 % positive for Landrace boars and 1 % for Large White boars. These results are corroborated by overseas research. Major breed differences occur. It is generally accepted that the Pietrain is about 100 % sensitive, Large White about 1 % and the various Landrace lines between 10 % and 30 %.

NATIONAL DAIRY CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

Both the volume and the quality of work for this scheme reached a new peak. With regard to the performance testing scheme, the following changes took place in comparison with last year:

- The number of herds increased from 1 040 to 1 092.
- The number of individual samples tested (butterfat, protein and lactose) increased from 646 000 to 689 600.
- The number of Frisian cows tested (72 % of all cows) increased from 36 976 to 37 328.
- The number of cows tested per month was 56 061, and 77 613 individual lactation records were issued, as against 69 742 the previous year.

An important new development was the introduction of a biological and economic analytical and advisory service for the herds participating. This service is offered in co-operation with the Department of Agricultural Economics and Marketing.

With regard to the progeny testing scheme, 219 young bulls were nominated for consideration as test bulls for the AI industry during the year. Ninety-five were found acceptable and 39 were purchased.

Semen from 45 bulls was distributed to test herds. Thirty-four of these bulls were Frisians, 5 were Jerseys, 3 Ayrshires and 3 Guernseys.

Contracts were entered into with 343 herds for 17 010 test cows. Of this number 243 were Frisian herds, with 12 293 test cows, and 74 Jersey herds, with 2 162 test cows.

ANIMAL HEALTH

VETERINARY RESEARCH INSTITUTE

The drought during the year under review had an inhibiting effect on diseases generally, especially on infectious diseases, with the result that fewer unexpected demands were made on the vaccine production and specialised diagnostic sections of the Institute. This, together with the farmers' poor economic position, resulted in a drop of almost 17 million (9,8 %) doses in the total issue of vaccines, reducing this total to 154,2 million doses.

African swine fever, which caused great consternation in international veterinary circles by the way it was spreading abroad, once more received considerable attention.

New viral diseases of turkeys have been discovered and are being intensively studied, and at the same time progress is being made with the investigation of coryza, Newcastle disease and the poultry diseases caused by mycoplasmas. Good progress has been made with the projects on the causes of geeldikkop and jaagsiekte.

Laboratory investigations have shown that poisoning from pesticides and urea, chiefly as a result of negligence, is still among the most important causes of cattle losses.

VETERINARY RESEARCH

DISEASES OF CATTLE

Bacterial diseases

A method was found to grow *Campylobacter fetus*, the cause of vibriosis of cattle, on a large scale in fermenters. This method made it possible to eliminate the backlog in the production of vaccine against this important venereal disease and to meet the steadily mounting demand for this vaccine.

Promising results were obtained in rabbits with a trial vaccine against *Staphylococcus aureus*, a cause of mastitis in cattle, and this led to a field trial in which the vaccine was tested in dairy cows. This trial has not yet been completed, but preliminary results are encouraging.

An examination for mastitis of a large number of milk specimens revealed that *Staphylococcus aureus* was the most important causal organism of this disease. Inspections *in loco* on farms where mastitis is a serious problem established that poor management is largely responsible. Therapy on these farms is ineffective and culling is done injudiciously.

The efficacy of four live and two inactivated vaccines against brucellosis was compared in guinea-pigs, following standard procedures. The comparison showed that the live vaccines, which include the Onderstepoort Strain 19 vaccine, provide better immunity than the inactivated vaccines.

Protozoal diseases

In a comprehensive study on the epidemiology of the tick-borne disease redwater the serological tests used for the purpose have been perfected and important observations have been made.

It is clear from these studies that, in the Transvaal and adjacent parts of the Orange Free State and the North-Western Cape, there are areas which differ radically with regard to the epidemiology of the two types of redwater which occur in South Africa. Recommendations based on this knowledge can now be made with reasonable confidence to individual farmers regarding the best measures to adopt to control redwater in specific areas.

It is now evident that there are at least three, and not merely two, *Theileria* spp. of cattle in South Africa, namely *T. lawrencei*, which causes Corridor disease, *T. mutans*, which is apparently not of any economic importance, and a *Theileria* sp. whose pathogenicity is still unclear.

T. mutans, like heartwater, is transmitted by the bont tick and may possibly be used as an indicator of the extent to which heartwater is being transmitted naturally on a farm, seeing that a good serological test for *T. mutans* infection has been

developed, while there is no comparable test for heartwater.

Infertility and venereal diseases

Further research work has been carried out on the isolation and identification of pathogenic microorganisms from bovine fetuses and afterbirths originating from farms where abortions occur. The following table gives an analysis of the findings:

	Percentage of farms infected	
	77/78	78/79
Brucellosis	21	14,5
Q fever	0,8	2,9
Campylobacteriosis (=vibriosis)	6,8	2,9
Chlamydiosis	4,5	5,9
C. pyogenes	3,0	1,7

Much research was devoted during the year to the cause of the so-called "epivag" syndrome. During visits to various farms where "epivag" had been reported, affected cows and bulls were clinically examined and specimens collected. Although a variety of agents were isolated, including *Actinobacillus seminis, Corynebacterium ovis, C. pyogenes, Chlamydia psittaci*, IPV virus and mycoplasmas, it was still not possible to produce the "epivag" syndrome with these isolates in the laboratory and the cause of the disease remains a mystery.

External parasites

Research in connection with the control of black flies (*Simulium* spp.) by means of water manipulation have produced further interesting data.

Interruption of the Vaal River for 48 hours at the Barrage had no effect on the midge population in the Parys-Orkney district because the numerous branching tributaries below the Barrage did not drain in time.

Closure at the Warrenton weir likewise had little effect on the midge plague at the Vaalhartz Scheme because the flies were breeding in the canal system below the weir. On the Orange River, however, closure of the river at the P.K. le Roux and Boegoeberg Dams had good results downstream for fully 400 km.

The investigation by means of tests on both larvae and adult ticks into the phenomenon of resistance of ticks to dips showed *inter alia* that field resistance to camphechlor, dioxathion and quinthiophos was still found in blue ticks from time to time, but the majority of blue and other tick species were still controlled adequately if the dips were used at the recommended strength.

Resistance by tick species other than blue ticks is usually absent or at such a low level that it does not present a practical problem.

In the research work on the possible use of suspensions of infected ticks as a vaccine against heartwater it was found that bacterial infection in nymphal suspensions could be controlled without detriment to the heartwater organism and, moreover, the organism itself remained comparatively stable during freezing and thawing.

The experiment in which the duration of immunity after inoculation of heartwater blood was determined established that cattle were still immune where challenged 3, 6 and 12 months after inoculation. At 24 months, 2 out of the 15 animals challenged showed slight febrile reactions at the expected time, but their blood was not capable of infecting sheep and they recovered without treatment. Fourteen (70 %) out of the 20 controls reacted to challenge, a clear indication that the Onderstepoort heartwater vaccine provides cattle with longer immunity than was previously supposed.

Internal parasites

Research on *Parafilaria* infestation (false bruising) in heifers and oxen established that the adult parasite lived for about a year, but that the oviposition periods were very much shorter. Re-infestation must therefore take place every year to enable the life cycle to be continued.

When all the cattle on the Soutpan Experimental Farm were treated with nitroxynil, and the treatment was repeated after an interval of six months, following previously defined regimens, bleeding points in indicator animals disappeared for all practical purposes.

However, despite the fact that the possibility of transmission was consequently restricted to a minimum, the re-infestation of young animals was not prevented during the next transmission season in the following spring. It is not possible, therefore, to clear a single farm in a *Parafilaria*-infected area by means of therapy.

Poisoning

Pesticides remain one of the commonest causes of animal poisoning. If strychnine is disregarded, approximately half of all cases of animal poisoning investigated by the Institute during the past year could be ascribed to injudicious or negligent exposure of animals to pesticides.

Parathion (an organophosphor pesticide) and dieldrin and thiodan (chlorinated hydrocarbon pesticides) were responsible for most deaths.

The incidence of poisoning of ruminants with urea is still unnecessarily high; 12 % of all poisonings (apart from strychnine poisonings could be attributed to the injudicious use of urea in rations and licks.

DISEASES OF SHEEP AND GOATS

Bacterial diseases

There are good grounds for assuming that the important pathological condition among sheep known as "redgut", which occurs in sheep ranging on intensive pastures, especially lucerne, is caused by *Clostridium perfringens* Type A.

An attempt is being made to develop a vaccine against the disease and preliminary tests on quinea-pigs have shown promising results.

Viral diseases

As the world reference centre for bluetongue, the Institute has rendered valuable service to Réunion, Brazil and Argentina. Types 2 and 4 of the bluetongue virus have been confirmed in the cattle population of Réunion, but only Type 2 has so far been transmitted to the sheep population, in which there has been some mortality.

Serum specimens from sheep received from Brazil contained antibodies against Type 1 of the bluetongue virus, but similar specimens from Argentina, taken from sheep with bluetongue-like symptoms, proved negative.

Representative strains of 15 out of the 20 known serotypes of bluetongue virus were purified and tested for safety and immunogenicity in sheep. The preliminary results were so promising that a new bluetongue vaccine consisting of a series of three injections was recently released for use.

The epidemic of Rift Valley fever which hit South Africa so badly a few years ago made imperative the development of an inactivated vaccine for immunizing pregnant ewes and cattle. An effective new vaccine was developed, but certain questions which arose during the outbreak regarding the interaction between the existing, attenuated vaccine and the new vaccine had to be answered.

It was established that the administration to sheep of the inactivated vaccine during an outbreak did not adversely affect the subsequent use of the attenuated vaccine. The later vaccine, however, was necessary to ensure lifelong immunity. Furthermore, it was confirmed that the administration of the attenuated vaccine to pregnant sheep caused growth abnormalities in unborn lambs.

	Diseases	Percentage of farms infected	
		77/78	78/79
Sheep	Chlamydiosis	9,3	16,8
	Q fever	2,3	3,9
	Vibriosis	0	1,3
Goats	Chlamydiosis	16,6	5,6

Infertility and venereal diseases

The following are the results of a routine investigation for pathogenic microorganisms in fetuses and placentas of sheep and goats that were either brought or sent to the Institute:

Internal parasites

Special attempts are being made to supply agricultural co-operatives, which are important channels for the distribution of worm remedies, with general information on the proper use of these drugs.

The Division of Veterinary Services, the Division of Agricultural Information and the Veterinary Research Institute at Onderstepoort have distributed a comprehensive brochure on the control of internal parasites, which was compiled during the year, not only to all agricultural co-operatives serving the livestock industry but also as widely as possible among farmers and other interested persons.

Poisoning

Considerable progress has been made with the project investigating the relationship between facial eczema and geeldikkop. The research work was carried out at Middelburg, Cape, in conjunction with the Division of Veterinary Services and the Plant Protection Research Institute.

DISEASES OF PIGS

Viral diseases

Good progress has been made with the serological survey of African swine fever in wild animals. Swine fever occurs in at least one area which was previously regarded as "free", namely the Mkuze Game Reserve, where the presence of the disease was confirmed by the isolation of the virus from tampans (*Ornithodorus*) taken from warthog burrows.

Tests carried out on sows have shown that parvovirus plays an important role in reproductive disturbances of pigs. Ten out of the 14 pregnant sows infected with the virus either aborted or resorbed the fetus. Indications have been found that the virus causes less damage if infection takes place late in pregnancy. Since there is every indication that this virus plays a very important part in the pig industry, attempts will be made to develop a vaccine to counter it.

Infertility and venereal diseases

The survey on the causes of abortions and infertility in pigs is making steady progress. There is no indication so far that dangerous infections, such as Aujeszky's disease and brucellosis, which are found in Europe and the USA, are present in this country.

DISEASES OF POULTRY

Viral diseases

A hitherto undiagnosed disease of turkeys in the Krugersdorp district, involving thousands of birds and a mortality figure of up to 54% in certain flocks has been attributed to a flavi virus isolated from the turkeys. This virus is possibly either related or similar to a meningoencephalitis virus described in Israel. The virus can be grown in cell culture and the possibility of producing a vaccine is the subject of a current investigation.

There has been considerable improvement in the diagnosis of infectious bronchitis of fowls following the correct application of two techniques in use overseas. One is the haemagglutination test. The other, the technique of direct isolation of the virus in embryonated eggs, has been made much more sensitive by an improved method. With this technique it is possible to demonstrate the presence of the virus in infected fowls within two days, even after a single passage.

DISEASES OF HORSES

Protozoal diseases

Tests for dourine were carried out on 3 631 specimens from the Republic during the year, 42 (1,2%) of which were positive. The distribution of these cases was as follows: Transvaal 12, Natal 17, Cape 13.

Positive specimens were also received from Bophuthatswana, Botswana, Lesotho, Transkei and Zimbabwe-Rhodesia.

DISEASES OF MISCELLANEOUS ANIMALS

Viral diseases

Promising results have been obtained in a field trial with cattle immunised by means of an experimental rabies vaccine propagated in tissue culture. The same vaccine has also produced promising results in immunised dogs. The vaccine will probably be released shortly for general use.

Of the 767 specimens tested for rabies during the year, 218 (28,4%) were positive, 147 of them from the Republic and 71 from South-West Africa/Namibia.

Preparation of culture media

More slaughtering was done at the Institute's abattoir than ever before and its capacity was again taxed to the limit. For example, 1 012 cattle, 89 horses and mules, 1 194 sheep and goats and 4 745 fowls were slaughtered. Most of the meat and specific organs were used for the preparation of culture media for vaccine production and research; the balance was used chiefly for rations.

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Five scientists or officials from African countries and nearby islands, namely from Lesotho, Mozambique, Zambia and Réunion, visited the Institute during the year.

Various neighbouring states received 6 877 743 doses of vaccine through official channels. The Institute also received 1 129 specimens for diagnosis from countries such as Botswana (276), France (7), Israel (46), Lesotho (33), Malawi (8), Mauritius (16), Oman (8), South West Africa/Namibia (429), Swaziland (173) and Zimbabwe-Rhodesia (133).

Liaison with overseas countries

Thirty scientists paid short visits to Onderstepoort during the year under review. In addition, 172 foreign tourists visited the Institute in various groups.

As the world reference centre for bluetongue and horsesickness, Onderstepoort was able to render valuable assistance to Réunion, Brazil and Argentina with the diagnosis of bluetongue and the identification of strains of the virus that occur in those countries.

VACCINES AND STOCK REMEDIES

VACCINE PRODUCTION

As in the past, a significant proportion of the total production was supplied to foreign countries direct. If the issues to South-West Africa/Namibia are included, this proportion amounted to approximately 5%. The income from these sales was nearly R189 000. Details of the doses supplied are as follows:

Country	Doses
Botswana	339 473
Lesotho	4 000
Malawi	120 000
Zimbabwe-Rhodesia	1 635 848
Mauritius	3 000
Swaziland	78 430
Zambia	2 543 370
Transkei	110 467
Israel	910 000
SWA/Namibia	1 153 155
	6 897 743

In addition to the above, a quantity of vaccine was also supplied to foreign countries through private trade channels.

REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

SWART STATE
BLACK STATES

GAZANKULU
LEBOWA
VENDA
NDEBELE

KWAZULU

BOPHUTHATSWANA

QWAQWA

TRANSKEI

CISKEI

GEBIED VOORLOPIG INGELYF
BY SWAZILAND

VEEARTSENYKANTORE
VETERINARY OFFICES

- Direkteur Veeartsenydiens / Director Veterinary Services
- Asst.-direkteur / Asst. Director
- Staatsveearts / State Veterinarian
- Veterinêre Streeklaboratorium / Regional Veterinary Laboratory
- Staatsveeartswykgrense / State Veterinary Areas Boundaries
- Streekgrense / Regional Boundaries

1. Winterreënstreek - Winter Rainfall Region
2. Oos-Kaap en Karoo - Eastern Cape and Karoo
3. Vrystaat - Free State
4. Natal - Natal
5. Oos-Transvaal - Eastern Transvaal
6. Transvaal - Transvaal
7. Hoëveld - Highveld

RHODESIA
MOCAMBIQUE
SUIDWES-AFRIKA
BASUTHO
ATLANTIC OCEAN
INDIAN OCEAN
KNP
SWAZILAND
SKUKUZA
LOURENCO MARQUES
MESSINA
SOUTPANSBERG
WATERBERG
MARICO
LYDENBURG
WITRIVIER
MIDDELBURG
CAROLINA
BETHAL
STEGI
HLATIKULU
VRYBURG 1
MAFEKING 1
DELAREYVILLE
LICHTENBURG
KLERKSDORP
VRYBURG 2
KURUMAN
GORDONIA
SCHWEIZER-RENEKE
WOLMARANSSTAD
HEILBRO
POSTMASBURG
BARKLY WEST
KIMBERLEY
HAY
HERBERT
KENHARDT
NAMAKWALAND
PRIESKA
HOPETOWN
FAURESMITH
PHILIPSTOWN
BRITSTOWN
DE AAR
CARNARVON
WILLISTON
VANRHYNSDORP
CALVINIA
VICTORIA WEST
RICHMOND
HANOVER
ALBERT
STROOMBERG
TARKASTAD
QUEENSTOWN
VREDENDAL
FRASERBURG
MURRAYSBURG
GRAAFF REINET
BEAUFORT WEST
ABERDEEN
CLANWILLIAM
SUTHERLAND
PIKETBERG
CERES
LAINGSBURG
PRINCE ALBERT
WILLOWMORE
JANSENVILLE
ALBANY
MALMESBURY
WORCESTER
MONTAGU
LADISMITH
OUDTSHOORN
UNIONDALE
STEYTLERVILLE
UITENHAGE
ALEXANDRIA
CAPE
ROBERTSON
GEORGE
KNYSNA
JOUBERTINA
HUMANSDORP
HANKEY
MOSSEL-BAAI
SWELLENDAM
HEIDELBERG
RIVERSDALE
CALEDON
SIMONSTOWN
BREDASDORP
DURBAN

1 2 3 4 5 6 7

REPUBLIEK VAN SUID-AFRIKA
LANDDROSDISTRIKTEKAART
REPUBLIC OF SOUTH AFRICA
MAGISTERIAL DISTRICT MAP

Okt./Oct. 1972

1 : 3,000,000

Myl 50 40 30 20 10 0 50 100 Miles

SKAAL SCALE

- Landdrosdistriksgrense ..... Magisterial District Boundaries
- Internasionale Grense ——·—— International Boundaries
- Provinsiale Grense ——··—— Provincial Boundaries
- Hoofdistriksdorpe • ..... Principal District Towns

Driehoeksmetingkantoor, 1961. Hersien 1972.
Trigonometrical Survey Office, 1961 Revised 1972.
T S O Misc 5310.

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PRYS PER VEL 60c PRICE PER SHEET

Staatsdrukker, 1972
Government Printer, 1972

Bacterial vaccines

The most important improvement in bacterial vaccine production was the development of an effective technique for the production of *Campylobacter (Vibrio) fetus* vaccine, which enabled the Institute to meet the demand for this product.

Certain problems regarding the immunisation of young lambs against enterotoxaemia are being investigated, and experiments aimed at improving the botulism and quarter evil vaccines are under way.

Virus vaccines

There was an increased demand for both rabies vaccine for cattle (HEP) and infectious bronchitis vaccine for poultry. However, the demand for vaccine against most of the insect-borne diseases (e.g. ephemeral fever, Wesselsbron disease and lumpy skin disease) as well as the demand for live Rift Valley fever vaccine and poultry vaccines generally decreased.

Protozoal and rickettsial vaccines

Issues of anaplasmosis vaccine decreased from 643 660 to 496 530 doses and those of besnoitiosis vaccine from 104 110 to 71 570 doses, but issues of redwater blood increased from 104 185 to 124 145. The demand for heartwater blood also continued its upward trend.

Antigens

A further marked increase in the demand for bovine and particularly avian tuberculin can be ascribed to more intensive testing for tuberculosis by the Division of Veterinary Services.

Antisera

In addition to the existing botulism antitoxin, a tetanus antitoxin was made available and has proved to be a useful addition to the series of products provided by the Institute.

VACCINE SALES

Vaccine	Doses issued 1976/77	1977/78	1978/79
Bacterial vaccines	86 467 030	91 611 402	84 334 834
Virus vaccines	71 735 195	78 254 945	69 054 464
Protozoal and rickettsial vaccines	1 034 206	970 503	814 555
Total for all vaccines	**159 236 431**	**170 836 850**	**154 203 853**
Diagnostic antigens (m*l*)	194 011	223 911	339 107
Antisera (m*l*)			1 387

DIVISION OF VETERINARY SERVICES

As a result of drought conditions prevailing over most of the Republic there were no major outbreaks of epizootic diseases except for outbreaks of foot-and-mouth disease.

These outbreaks were caused by the SAT II strain of the virus. The necessary control measures were immediately applied. These included the re-vaccination of susceptible animals in the threatened areas as well as on infected farms. Some of the epithelium from lesions from infected cattle was forwarded to the foot-and-mouth disease vaccine production laboratory in Botswana, which was prepared to produce a vaccine made from the relevant SAT II strain.

Enzootic bovine leucosis was diagnosed in two bulls from an AI Station in Natal. Both bulls came from the same farm.

The *bovine tuberculosis* eradication scheme is making rapid progress, especially since the introduction of the diagnostic herd testing scheme. The number of tuberculin tests carried out this year amounted to 4 468 785, and of these tests 484 112 were carried out by officers of the Division. The number of herds tested under the diagnostic scheme was 2 352 (compared to 577 herds the previous year), comprising 329 361 head of cattle.

The number of tuberculosis-free certificates issued to tuberculosis-free herds in accordance with the accreditation scheme was 4 336, which is an increase of 12,8 % over last year's figures.

Certain areas in the Western Cape are now free of tuberculosis and legislation which will make the testing of all herds in a defined area compulsory is being prepared.

A total of 217 sheep succumbed to *pulmonary adenomatosis* (jaagsiekte). Deaths were recorded mainly from the Western Cape. An experimental vaccine was used in flocks in the Lydenburg veterinary area.

The total number of herds accepted for *brucellosis* accreditation increased from 700 last year to 1 040 this year and 84 170 head of cattle were involved.

The number of brucellosis-free certificates issued increased from one in the previous year to 88 this year. Under the diagnostic scheme 2 956 herds, comprising 184 202 animals, were tested.

With the increase in outbreaks of *sheep scab* during the year under review it was decided, in co-operation with Organised Agriculture, that a single dipping of all sheep during the period 1 October 1979 to 31 January 1980 should be made compulsory. Legislation was prepared and a variety of pamphlets dealing with the control of sheep scab were distributed among farmers.

VETERINARY RESEARCH

Miscellaneous research projects

The AI and Reproduction Section investigated the possible effect of treatment of *Trichomonas*-infected bulls with IPZ and IPZ plus antibiotics on the spermiogram of bulls. They came to the conclusion that neither treatment had any effect on the spermiogram of bulls.

The Poultry Diagnostic and Extension Services Section, in collaboration with scientists at Onderstepoort, devoted considerable attention to the turkey rhinitis/sinusitis syndrome and successfully isolated the causative virus. Indications are that the virus is probably an influenza virus.

A disease of turkeys called turkey meningoencephalitis, which had hitherto been described only in Israel, was diagnosed in turkeys which showed nervous symptoms and a drop in egg production.

It was also shown that cases of ascites in fowls, formerly attributed to heart failure, could be reproduced experimentally by feeding toxic levels of furazolidone.

A fluorescent antibody technique for infectious bronchitis was developed during the past year. With this technique an diagnosis of infectious bronchitis can be made within two days, whereas the virus isolation technique previously used took up to 3 weeks before a diagnosis could be confirmed.

The survey on lung lesions in pigs revealed that inadequate ventilation, overcrowding or overventilation are predisposing factors in the presence of which *Mycoplasma* species may cause explosive outbreaks. Of the 18 474 pig carcases examined, 19,8 % showed lung lesions.

In continuing investigations on the causes of swine dysentery, *Treponema hyodysenteriae* has been isolated. In the treatment of this disease it was found that water medication is definitely superior to medicated feeds.

The mastitis control scheme launched by the Alberton laboratory continued to expand and 50 new herds were added to the scheme, bringing the total to 98 herds.

Research was also carried out on mineral deficiencies in animal feeds or grazing. It was decided to concentrate on blood analyses and analyses of the grazing or rations and to compare these with the actual requirements of the animal.

The Middelburg regional veterinary laboratory conducted experiments in order to develop and test a specific immune serum for the detection of pregnancy in ewes from day 6 to day 10. Some success was attained.

In conjunction with the Veterinary Research Institute, experiments on the aetiology of "geeldikkop" were continued. A major breakthrough was achieved in the extraction of the toxic fraction present in *Tribulis terrestris*.

It was proved last year that enzootic icterus was caused by chronic copper poisoning. Attention has this year been given to methods of treatment and prevention. It was found that zinc sulphate was as effective as sodium molybdate in preventing the disease and was in addition much cheaper.

Research on game and diseases of game

The activities of the veterinary investigation centre in the Kruger National Park were primarily directed towards foot-and-mouth disease control and research.

The buffalo cow which aborted last year after being artificially infected with a buffalo strain of *Brucella abortus* this year gave birth to a live calf.

Research done on anthrax by the research section of the Parks Board indicated that impala dosed with anthrax spore vaccine can survive if challenged artificially with a lethal dose of virulent kudu strain anthrax spores and become carriers of this disease. It was also found that vultures can act as carriers of the disease for at least 8 days following ingestion of infected meat.

Screening tests on different species of animals in the Kruger National Park were carried out to determine the host range of *Trichinella spiralis* in free-living wild animals. Two lions and one leopard were positive. It appears that trichinosis has predominantly a predator cycle in game animals.

Cropping of game during the year under review gave an excellent opportunity to study external and internal parasites of these species.

Internal parasites are listed below.

Nemastrongylus calcaratus (lungworm) was found in the lungs of impala, nyala and blesbuck.

Cordophilus sagittus (heartworm) was recovered from the heart of kudu.

Fasciola hepatica (liver fluke) Species infected were impala, nyala, blesbuck and blue wildebeest.

Stilesia hepatica (liver tapeworm) was found in the livers of impala, nyala and blesbuck.

Cysticercus tenuicollis (bladder worm) was found in springbuck, blesbuck and impala.

Cysticercosis (measles) was found in impala, nyala and wildebeest carcases.

A pelvic nematode which has not yet been identified was found in 80 % of all springbuck shot in SWA.

External parasites found on game carcases included *Strobiloestrus clarkii*. All the rhebuck shot in Colesberg district were found to be infested. A few springbuck from Prieska were also infested.

VACCINES AND ANIMAL REMEDIES

The following vaccines were produced by State veterinarians, veterinary laboratories and/or Regional veterinary laboratories:

Heartwater	9 242 doses
Autogenous wart	10 732 millilitres
Contagious pustular dermatitis (orf)	7 597 doses
Actinobacillus ligneresi	160 doses

The Regional veterinary laboratory at Stellenbosch prepared 2 100 mℓ leptospirosis antigen, and 849,3 mℓ of antigens, 106,0 mℓ of amboceptor and 866,2 mℓ of complement were prepared by the Regional veterinary laboratory at Middelburg (CP). The Regional veterinary laboratory at Allerton prepared 16 766 solid and 16 231 fluid media.

CONTROL OF ANIMAL DISEASES

NOTIFIABLE DISEASES

Foot-and-mouth disease

Outbreaks of foot-and-mouth disease occurred in the Gazankulu and Venda homelands. All the outbreaks were caused by SAT II.

Control measures were immediately applied, such as a total embargo on the movement of cloven-hoofed animals or their products, the isolation of the infected area through cordons and the vaccination of infected animals on infected farms and also susceptible animals on adjoining farms.

Due to the smuggling of cattle, small stock and even meat from Zimbabwe-Rhodesia across the Limpopo to Venda, a cordon was established along the Limpopo buffer zone fence which runs parallel to the Limpopo river. This cordon was established even before the outbreaks occurred.

With the outbreak of foot-and-mouth disease in Gazankulu and Venda, further inoculations were carried out using Burroughs Wellcome inactivated vaccine which included strains SAT I, II and III. In all 50 852 head of cattle around the original infection at Malamulele were vaccinated. From 7 to 11 May 1979 all cattle (7 104) in the infected dipping tank areas were inoculated with live virus and day and night patrols on the inner cordon were maintained.

Rabies

Of the 728 specimens submitted to the Veterinary Research Institute by the Division of Veterinary Services and the Black States, 225 (29,5 per cent) were positive for rabies. In the previous year 747 cases were reported of which 22,9 per cent were positive.

The eradication of jackals on farms seems to be the best solution. In the Johannesburg area two cases among meercat were diagnosed and an intensive campaign of poisoning with phostoxin tablets was implemented.

Control of this disease depends on the yearly inoculation of all dogs in the proclaimed areas of Natal and parts of the Northern and Eastern Transvaal.

In all 108 442 dogs and 6 323 cats were immunised against rabies by officers of the Division of Veterinary Services. Immunisation was also done in the Black states, where 47 873 dogs and 406 cats were inoculated.

Anthrax

Five outbreaks occurred during the year under review. After an absence of many years anthrax made its appearance in the Free State part of the Highveld Region and the Free State Region. Mortality caused by the outbreaks amounted to 36 cattle, 16 pigs and one sheep.

The outbreak among red hartebeest in the Kimberley district which was mentioned in the previous report is now under control.

As a general preventive measure and also during the outbreaks the officers of the Division of Veterinary Services inoculated 4 309 120 cattle, 11 104 head of small stock, 30 pigs and 42 horses.

In the Black states 1 825 689 cattle were immunised as a preventive measure by officers of the various veterinary services.

Tuberculosis

For the first time since the inception of the tuberculosis eradication scheme, there are more than a thousand farmers in each of two regions of the Division of Veterinary Services that can boast of tuberculosis-free herds. The Western Cape Region passed this milestone in November 1978, the Highveld region accomplished it on 1 December 1978.

The good progress made in the Western Cape Region has acted as an incentive for the Division to give serious consideration to the total eradication of bovine tuberculosis in that region.

The necessary legislation for the compulsory testing of all animals in this region has already been drawn up.

During the year under review 4 336 (3 843)certificates were issued to tuberculosis-free herds, and 6 033 (5 207) herds participated in the eradication scheme.

Since the initiation of the scheme 854 (748) previously infected herds have now qualified for tuberculosis-free certificates.

Bovine brucellosis ***(Brucella abortus)***

The number of heifers, over the age of three months but still under the age of 11 months, inoculated during the year under review with Strain 19 vaccine in White areas either by or under the supervision of officers of the Division of Veterinary Services amounted to 575 443. The number vaccinated in Black States was 93 464.

Where infection is confirmed in a herd, written permission can be obtained from the local State veterinarian for the inoculation of females over the age of 11 months. In this way 6 058 (9 188 - 1977/78) females were vaccinated during the year.

The voluntary accreditation scheme has shown remarkable growth during the year under

review. A total of 1 040 herds comprising 84 170 cattle joined the scheme. A total of 88 brucellosis-free certificates was issued.

The diagnostic scheme which was launched on 1 July 1977 has made excellent progress. A total of 184 202 animals from 2 956 herds were tested. Of these 1 344 herds (45,4 %) and 10 387 (5,6 %) cattle were positive.

Trypanosomiasis

Nagana

During November 1978, a single suspected case of trypanosomiasis *(T. congolense)* was found in a horse in the Mkuze game reserve. A subsequent survey suggested that a flare up of the disease is unlikely at this stage.

The control of tsetse flies in the Caprivi is now the responsibility of the Division of Veterinary Services in South West Africa/Namibia.

Dourine

Of the 3 443 samples tested by the Veterinary Institute and other Regional veterinary laboratories 55 (1,6 %) were positive.

Lumpy skin disease

Outbreaks occurred throughout the Republic except for the Western Cape Region. The incidence was low except in the Natal and Transvaal Regions.

Officers of the Division of Veterinary Services inoculated 69 685 head of cattle against the disease.

Three hundred and seventy-eight animals were inoculated in Qwaqwa and 49 672 in Lebowa.

Sheep scab

The number of outbreaks increased from 320 in 1977/78 to 351 in the year under review.

Preparations were made for compulsory dipping, which will start on 1 October 1979 and last until 31 January 1980.

A sheep scab liaison committee was also formed to deal with certain problems. All interested parties are accommodated in this committee.

Legislation was prepared for the compulsory dipping of all sheep in the Republic of South Africa. Neighbouring states were also contacted in order to bring their dipping program in line with that of the Republic.

Pamphlets dealing with the economic importance of sheep scab, the methods of dipping and the erection of dipping tanks were distributed among farmers.

Additional expenditure of R920 000 for this campaign was approved by the Treasury.

In all 806 047 head of small stock, 89 601 of which were in the Black States, on infected or contact farms, were dipped at least twice.

Mange

Sporadic cases of cattle mange were observed in all the regions except in the Highveld and Transvaal Regions, where the incidence of the disease was high, especially among dairy cattle.

Pig mange was a common problem in all the regions and also in Lebowa, Gazankulu and Venda. With the advent of new dipping compounds this problem can now be solved.

African swine fever

Three outbreaks of African swine fever occurred in the swine fever control areas. One outbreak involving 9 pigs occurred on a farm in the Thabazimbi district.

Swine fever control measures are still being employed as before.

Swine erysipelas

The disease occurred in all the Regions of the Division and there were 32 outbreaks in all.

Administration of antibiotics, together with improved hygiene and preventive inoculation, effectively controls the disease.

Infectious laryngotracheitis

An outbreak which occurred near Johannesburg caused fairly extensive mortality in a broiler flock. Follow-up investigations appeared to indicate that infection was fairly common with a virus which was of low virulence but which was capable of causing problems when complicated by other debilitating conditions or respiratory ailments. This disease can be combated by immunising fowls at the age of 2 weeks.

Newcastle disease

Isolated outbreaks occurred in the Transvaal, Natal, Eastern Cape and Karoo and Northern and Eastern Transvaal Regions. Sporadic outbreaks occurred in Venda, Gazankulu and Lebowa. Compulsory vaccination of fowls in Lebowa was stopped and farmers now do their own inoculations. A total of 66 256 fowls were vaccinated.

NON-NOTIFIABLE DISEASES

Bacterial diseases

Mastitis

In the Natal Region the Mastitis Control

Scheme continued to expand and 50 new herds were added to the scheme during the year, bringing the total membership to 88 herds.

A study group was formed in the Western Cape Region under the leadership of the State Veterinarian of Mossel Bay to deal more effectively with all aspects of this disease. The extension officer as well as all veterinarians in private practice have been included in this study group.

In KwaZulu mastitis was caused mainly by tick bites. With the use of a new dipping compound there was a marked decrease in the incidence of mastitis.

Enterotoxaemia (pulpy kidney)

As a result of the drought conditions of the OFS Region farmers have been forced to feed their sheep emergency rations and the resultant alteration in ruminal flora has caused an increase in the incidence of the disease. It is also estimated that only 20% of farmers inoculate against *enterotoxaemia*.

It is reported from the Eastern Cape and Karoo Region that there are indications that the oil-emulsion vaccine is not providing satisfactory immunity.

Black quarter

Except for the Western Cape Region, where sporadic cases occurred in the Mossel Bay veterinary area, this disease was rife throughout the other regions of the Republic. The occurrence of this disease is mainly due to the neglect of farmers to immunise their cattle timeously.

The fluorescent antibody technique employed by the Regional veterinary laboratories and other veterinary laboratories has enabled the officers of the Division to distinguish between the causal organisms, thereby making it possible for the Veterinary Research Institute to provide specific vaccines to control such outbreaks.

Botulism

An antitoxin was developed by the Veterinary Research Institute at Onderstepoort for use as an aid in the treatment of early cases of botulism in horses, cattle, sheep, chickens and waterfowl.

Corynebacteriasis

This disease was widespread throughout the Republic, in cattle as well as sheep.

Spinal abcesses in lambs have been reported from the OFS Region after tail docking.

The abscesses occurred mainly in the lungs and livers. In calves the infection was mainly confined to the joints. In the Eastern Cape and Karoo Region the infection is commonly associated with shearing wounds and bad hygiene in shearing sheds. In the East London State veterinary area the mass infestation of the head and ears of goats mainly by the tick *Rhipicephalus appendiculatus* causes meningeal and hypophyseal abscessation.

It was found that the available vaccines are not correctly used.

Pasteurellosis

This disease was encountered throughout the Republic in cattle as well as small stock.

In the Transvaal Region blue udder in sheep was in some cases the sequel to infection with this organism.

Anaphylaxis following inoculation with *Pasteurella* vaccine caused the deaths of 3 calves, 7 goats and 3 adult cattle in the OFS Region. Calf rearing units were affected in the Western Cape Region.

Tetanus

In practically every case reported the elastrator rubber ring, which is used for castrations and docking the tails of lambs, was involved.

An antiserum, for the treatment of early cases of tetanus in horses, cattle, sheep and dogs, was made available by the Veterinary Research Institute.

Colibacillosis

In the Northern and Eastern Transvaal Region mortality was high in two piggeries until the *E. coli* vaccine was used. Seven young elephants kept in captivity in the Kruger National Park died of colibacillosis.

Deaths occurred in high density calf and pig rearing units in the Western Cape. Poor housing and management were responsible for the condition developing. With improved management and the use of the Onderstepoort vaccine this disease can be combated.

Leptospirosis

A total of 3 500 doses of *Leptospira pomona* experimental vaccine were issued to the three piggeries where outbreaks of this disease had occurred. The vaccine gave very promising results.

Strangles

A severe outbreak of strangles involving 50% of the horses at a riding school occurred in the Natal Region. With suitable treatment all the horses recovered.

Protozoal diseases

Babesiosis

This disease was prevalent in all the Regions. In the Natal Region it was one of the most

important diseases.

There was a dramatic decrease in mortality among cattle in KwaZulu due to the use of a new acaricide. In certain areas where the dipping of cattle was interrupted when the dipping tanks had to be used for sheep scab control there was an immediate increase in the number of cases of redwater.

Anaplasmosis (gallsickness)

The disease is probably the most common disease of cattle in the Highveld Region. Officers of the Division inoculated 4 561 head of cattle.

In the Natal Region the vaccine is used extensively. The State Veterinarian at Vryheid reported 145 outbreaks involving 283 cattle, however.

Virus diseases

Bluetongue

A total of 34 deaths were reported from the Highveld Region. Officers of the Division assisted farmers in inoculating 21 075 sheep.

In the Western Cape it is estimated that 85 % of the farmers inoculate their sheep against this disease.

Heartwater

In the Highveld Region the disease has become established in the Marico district, where a farmer lost 34 head of cattle during the year under review. The usual drugs used against heartwater are not having any effect in curbing this disease in this specific district.

Officers of the Division assisted farmers in inoculating 1 353 cattle.

Heartwater caused heavy losses among cattle, sheep and goats in Lebowa, KwaZulu, Venda and Gazankulu. The heartwater problem can be partially solved by making use of heartwater blood.

Bovine malignant catarrh

In the 6 outbreaks which occurred in the Natal and Transvaal Regions there had been contact with blue wildebeest.

Infectious opthalmia

The disease was widespread throughout the Republic except for the Northern and Eastern Transvaal Regions.

The State Veterinarian, Bloemfontein estimated that 20 % of calves in his area were affected.

In the Karoo Midlands chlamydial organisms were demonstrated in conjunctival smears of infected as well as a percentage of non-infected sheep.

Contagious pustular dermatitis (vuilbek, orf)

Autogenous vaccines were prepared at the Middelburg, Queenstown and Grahamstown laboratories. This vaccine gives excellent results if administered timeously.

Infectious bovine rhinotracheitis

Isolated cases were reported from feedlots in the Pretoria, Vrede and Ermelo districts.

Blood samples from two herds in the Queenstown veterinary area with the suspected IPV form of the disease were found positive at the Veterinary Research Institute, Onderstepoort.

Enzootic bovine leucosis (EBL)

As a result of a suspected case of *enzootic bovine leucosis* in a bull from an AI Station in Natal the animal concerned was slaughtered and autopsied.

The diagnosis was confirmed on histological findings by the Veterinary Research Institute at Onderstepoort.

Vibriosis

The disease was diagnosed in all the Regions. An examination of sheath washings of 3 695 bulls showed that 123 (3,3 %) were positive for vibriosis.

There is a vaccine available which, if correctly used, will control this disease.

Trichomoniasis

Trichomoniasis infection of bulls was diagnosed in all the Regions as a cause of reproduction failures. Sheath washings of bulls were examined by the Veterinary Research Institute, Regional veterinary laboratories and veterinary laboratories and 101 out of 3 695 (2,7 %) examined were positive for trichomoniasis.

Actinobacillus seminis

The Regional veterinary laboratory at Middelburg (Cape) maintains that this disease is responsible for considerable losses to stud farmers, who lose up to 20 % of their sale rams as a result of epididymitis caused by this organism.

A total of 4 445 serum samples from sheep in the Western Cape, Eastern Cape and Karoo, Free State and Transvaal Regions were examined for this disease.

It is interesting to note that in the Highveld Region 10 (4,5 %) of the 221 sheath washings taken from bulls were positive for *Actinobacillus seminis*. In cows 38 (22,4 %) vaginal and/or uterine mucus samples from 170 cows were positive.

Brucella ovis

Of the 9 935 samples submitted for examination in the Western Cape and Eastern Cape and Karoo Regions, 746 (7,5 %) were positive for *Brucella ovis*. In the Free State Region 4 767 samples were tested and of these 426 (8,9 %) were positive.

The relatively high percentage of positive rams indicates that farmers are not making use of the available Rev. 1 vaccine, which gives excellent results.

Infectious epididymitis/vaginitis ("Epivag")

This disease is far more prevalent than was previously realised. In the Natal Region a diagnosis was made on 45 cows and 1 bull at the abattoir. In the Transvaal Region the condition was encountered in 2 large herds with approximately 750 breeding cows.

The condition was reported to be widespread in the Louis Trichardt State veterinary area.

Diseases of calves

White scours

This disease occurred in calves throughout the Republic. Good extension work by the Regional veterinary laboratory at Stellenbosch and field staff has brought the incidence down to between 2 % and 3 %.

Poor hygiene and management were a major cause of outbreaks.

Entero viruses

In the Western Cape Region where calves are kept in calf rearing units with an automatically controlled environment mortality following diarrhoea occurred in animals aged 4 to 8 weeks. The mortality rate was as high as 23 % and the only pathogen that could be identified in some cases was a Rota virus.

Upon the advice of the Regional veterinary laboratory at Stellenbosch the temperature of 18 °C was raised to 21 °C and no further deaths occurred. The experimental inactivated Rota virus vaccine used on 6-8 month pregnant cows made no difference to the susceptibility of their progeny.

Diseases of poultry

The volume of work of the Poultry Diagnostic and Extension Services Section of the Division of Veterinary Services at Onderstepoort showed a marked increase compared to the previous year. This increase can probably be ascribed to more birds being done for specific groups of poultry farmers than to a deterioration in the general health status of poultry in this country.

Fortunately for the poultry industry the incidence of respiratory diseases was low.

Infectious coryza

There has been a marked increase in the incidence of this disease, mainly in young pullets 6 to 8 weeks of age in the Natal and Western Cape Regions. Prophylactic vaccination was not always successful.

The practice of infecting vaccinated point-of-lay pullets as soon as they arrived on the farm was sometimes employed.

Chronic respiratory disease (mycoplasmosis)

The Poultry Diagnostic and Extension Services Section at Onderstepoort played an important part in helping to control mycoplasmosis by isolating and identifying mycoplasmas from field cases, using the FA test. Just about all the parent flocks of broiler producers are negative for *Mycoplasma gallisepticum*.

Epidemic tremor

A few cases were diagnosed in the Natal and Highveld Regions. It would appear that the disease was being controlled by the extensive use of vaccine.

Diseases of pigs

Vibrionic dysentery

For the first time *Treponema hyodysenteriae*, the cause of the disease, was isolated and the organism grown successfully on several media.

Respiratory disease syndrome

The above condition was diagnosed on 3 farms in the Natal Region and three new outbreaks were diagnosed by the Regional veterinary laboratory at Stellenbosch. Outbreaks were speedily brought under control by the addition of antibiotics to the rations and by correcting housing faults.

DEFICIENCY AND NUTRITIONAL CONDITIONS

Supplementary feeding and the use of stock licks are becoming more popular and fewer problems due to malnutrition were therefore encountered.

In the Bethlehem district urinary calculi developed in rams and hamels that were fed rations too high in phosphates. Ammonium chloride was used successfully in the treatment of some of the cases.

Manganese deficiency

At the Potchefstroom College of Agriculture 10 % of hamels in an intensive feedlot were affected with bow legs. This was found to be due to manganese deficiency.

The deficiency was also diagnosed on a sheep farm in the Malmesbury district, and in the Kimberley State veterinary area.

Vitamin A deficiency was believed to be involved in outbreaks of abortion amongst Boer goats in the Middelburg (CP) State veterinary area. These abortions ceased after the administration of Vitamin A.

Vitamin E deficiency was confirmed in chickens in the Louis Trichardt and Belfast districts. A multivitamin solution added to the drinking water solved the problem.

POISONING

Mineral poisoning

The usual spate of mortality due to carelessness or accidental intake of poisons was reported from all parts of the Republic.

INTERNAL PARASITES

Owing to the drought conditions that prevailed over most of the country, serious problems with internal parasites were not encountered.

In all the Regions except the Transvaal Region *Haemonchus* spp. (wire worm) was the most common of the parasites that caused problems.

Parafilaria bovicola infestation was diagnosed in the Free State and Eastern Cape and Karoo Regions. It is still a problem in the infected areas of the Natal, Transvaal and Northern and Eastern Transvaal Regions.

Observations in the Transvaal Region seemed to indicate that the regular use of arsenical dipwash was almost able to prevent infection.

EXTERNAL PARASITES

Although not as numerous as in the previous year, problems with tick-borne diseases were still encountered throughout the country. A population explosion occurred among ticks in the Western Cape Region, no doubt because of favourable climatic conditions.

Simulium midges occurred in epidemic proportions on farms bordering on the Vaal, Mooi and Orange Rivers. Breeding was prolific during long periods of constant water flow in these rivers.

Scientists from Onderstepoort estimated that one chemical treatment of the Orange River would cost at least R2 million. When the water levels are lowered the larvae are exposed to direct sunlight and dessication and soon die. In this way a certain amount of control can be exercised. On the other hand, the irrigation farmers are inconvenienced when their water supply is cut off. *Simulium* midges can have a devastating effect on livestock: They not only suck blood but also inflict numerous stings which can be so painful as to prevent animals from feeding. Farms as far afield as 30 kilometres from these rivers reported black fly problems.

ARTIFICIAL INSEMINATION

The testing of bulls at AI centres in Natal and the Western and Eastern Cape was carried out at the Regional veterinary laboratories at Allerton (Natal) and Stellenbosch (Western Cape) and the veterinary laboratory at Grahamstown. All other AI bulls were tested, as in the past, by the AI and Reproduction Section of the Division of Veterinary Services, in conjunction with the Veterinary Research Institute. During the year under review 232 were tested for this purpose.

At present, there are 64 AI bulls for which progeny testing has been completed. Fifty-six of these are dairy breed bulls.

The total number of doses of semen sold by AI centres during 1978 was 529 718 (529 874 in 1977). Of this number, 393 938 doses were from dairy breed bulls and 135 780 from other bulls. AI centres collected 94 754 doses of semen from 346 private bulls on behalf of their owners.

A total of 15 656 doses of bull semen, 90 doses of sheep semen and 68 doses of pig semen were imported.

ANIMAL HEALTH EXTENSION SERVICE

The extension services rendered to farmers by officers of the Division of Veterinary Services are continuing to expand. In addition to the Division's contribution to the training of prospective farmers at agricultural colleges, and the compilation of pamphlets and other literature, the following tasks are undertaken:

Farmers' days are arranged and addressed, articles are published in local papers and agricultural journals, farmers unions and study groups are addressed, radio talks are given, short courses on stock diseases are offered and programmes for vaccination and dosing are drawn up.

Individual farmers are given advice by State veterinarians and stock inspectors on farming and veterinary problems, improved stock farming practices and the advantages to be gained by joining disease eradication schemes, such as the bovine tuberculosis and brucellosis schemes.

AI Training

Courses offered	Registerable inseminators		Owner insemina-tors		Labourers	
	Courses	Candidates passed	Courses	Candidates passed	Courses	Candidates passed
AI and Reproduction Section	2	36	2	32		
SV Potchefstroom	3	30	10 (cattle)	170		
			3 (sheep)	22		
SV Bloemfontein			3	61		
SV Stellenbosch			3	57		
SV Mossel Bay			4	47		
SV Pietermaritzburg			2	20		
SV Kuruman			1	13		
SV Louis Trichardt			1	13		
SAAU (officers of the Division render assistance)						
Training centre at Boskop					12	86
Total	**5**	**66**	**29**	**435**	**12**	**86**

IMPORT AND EXPORT CONTROL

Import control

To prevent the introduction of stock diseases from other countries, the Division uses quarantine stations for animals and birds at Jan Smuts Airport, Durban, Cape Town and Walvis Bay.

A large variety of animals were imported for various purposes.

Various hunting trophies, 30,55 kg of biltong, 31 kg of meat and 24 insects, which had been brought into the country illegally, were seized and destroyed at Jan Smuts airport.

Export Control

Officers of the Division of Veterinary Services carried out veterinary examinations and issued certificates in respect of numerous kinds of animals intended for export to neighbouring states and overseas countries.

Certificates for a large variety of products being exported were also issued by officers of the Division.

TRAINING

State veterinarians of the Division gave lectures on veterinary science at all the agricultural colleges.

The in-service training of members of the inspectorate staff was continued, and three courses for 71 officials were held during the year. Since September 1972, 596 officers have been trained in this way. In-service training of members of the inspectorage staff in the performance of tuberculin tests in terms of the bovine tuberculosis eradication scheme was continued when 24 officers attended a course. There are now 112 officers capable of performing tuberculin tests on cattle.

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Visits were paid to the Head Office of the Division by scientists from Zimbabwe Rhodesia, Transkei and Bophuthatswana.

Liaison with overseas countries

Scientists from New Zealand, Italy, West Germany, Great Britain, Holland and France paid official visits to the Head Office of the Division during the year.

The Regional veterinary laboratory at Stellenbosch was visited by 13 overseas scientists and the veterinary laboratory at Skukuza received 8 visiting scientists. The visitors came from Paraguay, the USA, Australia, France, Great Britain, Italy, Holland, Canada, Switzerland, West Germany and New Zealand.

DIAGNOSTIC SERVICES

Apart from diagnostic services rendered by State veterinarians in their own areas, the Division has four Regional veterinary laboratories, at Allerton, Middelburg (Cape), Stellenbosch and Windhoek, as well as smaller veterinary laboratories at Grahamstown, Bloemfontein, Queeenstown, Kroonstad and Potchefstroom. The additional laboratory at Skukuza enables the Division to keep track of animal diseases occurring among game in the Kruger National Game Reserve. Furthermore the Poultry Diagnostic and Extension Services Section and the AI and Reproduction Section of the Division at Onderstepoort offer a very comprehensive service to poultry and cattle farmers. These laboratories do a great deal to assist State veterinarians and also play an increasingly important part in extension.

There was an increase of 40% in the diagnostic services rendered by the Division.

Distribution of cattle

Region or self-governing Black state	White owners	Non-White owners
Western Cape	373 166	6 297
Eastern Cape and Karoo	964 250	41 473
Transvaal	1 990 525	170 271
Natal	1 271 497	273 391
Free State	1 688 753	34 296
Highveld	2 008 778	99 670
Northern and Eastern Transvaal	1 064 248	109 647
Total	**9 361 217**	**735 045**
Venda	-	145 703
Gazankulu	-	178 682
Lebowa	-	435 384
KwaZulu	-	1 430 548
QwaQwa	-	14 873
Ciskei	-	200 581
Total	**0**	**2 405 771**
Grand total	**9 361 217**	**3 140 816**

MEAT HYGIENE

ADMINISTRATION

Abattoirs

According to the register kept by the Chief Meat Hygiene Officer in terms of section 3 of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), a total of 1 138 abattoirs in the Republic possessed valid certificates of approval on 30 June 1979.

During the year certificates of approval were issued to 42 red meat abattoirs, 23 poultry abattoirs and 2 rabbit abattoirs for the first time.

Certificates of approval were withdrawn from 31 red met abattoirs, 23 poultry abattoirs and 1 rabbit abattoir, which were then closed for various reasons.

Sterilisation plants

At present there are 98 sterilisation plants registered in terms of Act 36 of 1947 in the Republic of South Africa.

These plants, which produce fish meal, carcase meal, blood meal, bone meal, fish oil and tallow, are inspected at least once a year by State veterinarians for the purpose of either registration or re-registration.

Planning

In accordance with the provisions of section 18 of Act 87 of 1967, the Division of Veterinary Services examined 324 sets of plans for the erection, improvement and extension of abattoirs.

This required detailed written comments and recommendations on 993 drawings.

Meat Imports

A limited amount of low-grade industrial meat was imported from Zimbabwe Rhodesia and Botswana.

Meat Exports

The following quantities of meat were exported during the year:

Stock Census

Region or self-governing Black State	Cattle	Sheep		Goats	Horses	Donkeys and mules	Pigs	Fowls	Dogs
		Woolled	Non-woolled						
Western Cape	379 463	3 122 023	1 410 291	356 996	18 044	10 468	223 451	7 039 741	43 070
Eastern Cape & Karoo	1 005 723	7 841 791	1 765 434	1 392 597	32 006	9 193	71 702	3 216 538	68 055
Transvaal	2 160 796	2 573 793	251 966	88 628	36 025	8 992	249 382	8 938 530	406 216
Natal	1 544 888	989 258	103 946	134 253	25 121	3 532	127 348	3 111 015	119 501
Free State	1 723 049	3 095 808	5 013 222	465 176	46 426	10 391	94 922	1 020 892	65 362
Highveld	2 109 448	2 535 805	350 275	47 671	53 420	3 790	211 720	3 335 753	129 083
Northern and Eastern Transvaal	1 173 895	251 202	135 363	112 756	7 309	11 992	80 039	1 055 843	54 838
Total	**10 096 262**	**20 409 680**	**9 030 497**	**2 598 077**	**218 351**	**58 358**	**1 058 564**	**27 718 312**	**886 125**
Venda	145 703	-	3 322	44 392	32	4 571	6 203	31 196	12 078
Gazankulu	178 682	-	2 524	68 490	-	5 816	14 783	154 963	22 325
Lebowa	435 384	Not divided	68 939	358 903	140	27 272	38 857	442 189	39 567
KwaZulu	1 430 548	54 504	103 889	561 619	46 962	Not divided	32 014	1 067 259	100 203
QwaQwa	14 873	Not divided	2 468	11 667	527	57	169	22 839	867
Ciskei	200 581	225 894	Not divided	198 179	4 995	641	15 981	149 227	17 767
Total	**2 405 771**	**280 398**	**181 142**	**1 243 250**	**52 656**	**38 357**	**108 007**	**1 867 673**	**192 807**
Grand total	**12 502 033**	**20 690 078**	**9 211 639**	**3 841 327**	**271 007**	**96 715**	**1 166 571**	**29 585 985**	**1 078 932**

	Overseas	Neighbouring countries
Frozen, refrigerated and canned red meat	14 642 tons	5 258 tons
Meat products	100 tons	330 tons
Poultry	30 133 tons	1 158 tons
Game	2 760 tons	
Ostrich meat	128 tons	

MEAT INSPECTION SERVICES

Departmental

The Division is responsible for meat inspection services at abattoirs belonging to or managed by the Abattoir Corporation, as well as at privately owned abattoirs approved as export establishments. During the year these abattoirs slaughtered:

Cattle	1 117 056
Sheep	3 004 347
Pigs	616 267

GRAZING UTILISATION RESEARCH

NATURAL GRAZING

Bushveld areas

Research on the effect of the chemical control of bush encroachment on the veld and on livestock production was continued. The latest information indicates that the rate of re-encroachment and regrowth is determined by the degree of control obtained initially. Where effective control was obtained, encroachment appears to be only a minor problem for periods of 10 years or even longer. On the other hand, where there was poor initial control, re-encroachment causes difficulties after only a few years.

Research projects on the yields produced by individual grass species and stock grazing preferences are proceeding. This information is of cardinal importance in the application of controlled selective grazing. These projects revealed that a species such as *Chrysopogon serrulatus* is by far the most palatable, but that *Themeda triandra* and *Cymbopogon plurinodis* are the most productive.

Karoo areas

The pasture productivity model developed for Karoo veld is undergoing further testing and refinement as more infomration becomes available.

An investigation completed during the year under review revealed that a serious problem is developing in the Karoo areas of the Orange Free State Region as a result of the fact that three-thorn rhigozum *Rhigozum trichotomum* is spreading and becoming denser. The total area involved is estimated at about 1 166 000 ha.

Central grassveld areas

The investigation into the nutritional value of natural veld and the effect of supplementary feeding was continued in the OFS Region. Supplementation was placed directly in the rumen of sheep every day, via rumen cannulas.

The effect of the supplementation is determined by means of parameters such as changes in body mass, wool production in Merinos, voluntary feed intake, selective grazing habits, rumen ammonia concentrations and mineral status (blood and bone) of the sheep. With the exception of rumen ammonia concentrations, no definite effect could be ascribed to the supplementation. This gives rise to the question whether the practice of providing nitrogen and phosphorus supplementation to dry sheep on grass pastures in the Central Orange Free State is efficient and economically justifiable.

The results of a comprehensive investigation in which mutton production was researched under four rotational grazing systems and at two grazing intensities were processed: In the course of the investigation, which spanned seven seasons, it was found that with multi-camp systems and a rapid rotation of camps veld grazing is available for a longer period during dry seasons than where there are fewer camps and the rate of rotation is slow. Apart from the greater flexibility of a multi-camp system, none of the multi-camp systems (6, 12 and 18 camps) produced consistently higher animal production than the standard three-camp system. The condition of the veld where the investigation was carried out was relatively good, and the veld varied from subclimax to climax *Themeda* grassveld. Under the weather conditions that prevailed during the investigation none of the camp systems applied had a significantly adverse or favourable effect on the botanical composition of the veld.

According to the research programme carried out in the dry grass-bush communities of the Eastern Cape, in the majority of cases bush should be regarded not as a threat but as a valuable part of the ecosystem. If browsers are included in the beef production system, red meat production in these communities can be boosted by 50 %. Results show that the farm income per R100 of capital investment obtained from a beef cattle/Boer goat production system amounts to R48,94 at present, as against R19,75 from a beef production system.

High-potential areas

The application of controlled selective grazing on sourveld at the Athole Experimental Farm over a period of seven years reduced both the period for which it was necessary to supply winter feeding and protein supplementation requirements in autumn.

During the year considerable progress was made with the development and testing of a technique to determine the condition of the veld and the way it is developing. This technique provides a very simple method of describing and monitoring the condition of the veld with a view to adapting the sytem of management.

ARTIFICIAL PASTURES

Legumes

Increasing interest was shown in legumes as a source of nitrogen. The programmes in which new introductions and other legumes are being evaluated, particularly for use in the summer rainfall areas, were continued.

Preliminary findings of previous years, namely that cold weather legumes could play a bigger part in the summer rainfall areas, were confirmed by results obtained during the year under review. These crops make good use of autumn rains to provide winter grazing and respond well to irrigation.

Early cultivars such as Ghor and Cyprus *Medicago truncatula* produced 4 to 5 tons of dry mass per ha virtually without irrigation, and serradella *Ornithopus sativus* and subterraneum clover *Trifolium subterraneum* cv. Northam A responded very well to irrigation and produced 16 and 13 tons of dry mass per ha, respectively.

In a field trial on moist soil in the Waterberg area ordinary serradella *O. sativus* established in February produced 8 tons of dry mass per ha without irrigation. Yellow serradella *O. compressus* also appeared very promising.

The multiplication in fields of the seed of pasture legumes in order to supply seed for Departmental research programmes continued. During the year the nurseries at Rietondale were able to supply seed to the Regions for experimental work.

In a yield trial with hot weather legumes a number of crops were compared at various lime and phosphorus levels. Although the soil was exceptionally sour (pH 4,0 : KC*l*), none of the species responded to liming. *Macroptilium atropurpureum* (cv. siratro) and *Stylosanthes guianensis* (cv. Oxley) responded to increased phosphorus levels up to and including 40 kg of P/ha, but *Aeschynomene falcata* (cv. Bargoo) showed no increase in the yield above 20 kg of P/ha. Despite a very dry season, these species survived well and produced satisfactory quantities of seed.

The national lucerne breeding programme produced good results. The development of acid-tolerant lucerne types showed that if acid-tolerant genotypes are used an increase of up to 40 % in the yield can be obtained at lower lime and phosphate fertilising levels. The incidence of aphids was high during the year under review, which made it possible to form a very good idea of the resistance of the local lucerne breeding material to this insect. In lucerne cultivar trials with imported cultivars, some imported cultivars which were resistant to aphids produced higher yields than the better adapted local material.

Grasses

The evaluation programme with blue buffalo grass *Cenchrus ciliaris* which was being carried out in the Transvaal Region, has now been completed. Sufficient results are available at present to enable recommendations to be made on the cultivation and utilisation of *Cenchrus ciliaris* in most areas.

It was found in the course of an investigation in the Free State Region that there is little difference during the summer months between the digestibility and quality of *Cenchrus* and those of red grass. The carrying capacity of artificial fertilised *Cenchrus* is four to five times that of the natural veld, however.

After five years' research at Nooitgedacht to determine the relative palatability and the voluntary intake of *Eragrostis curvula* cultivars in the form of hay, it became evident that *management* (stage of cutting, season and level of fertilising) plays a decisive part.

Eragrostis curvula/lucerne mixtures for both hay and grazing produced very promising results during the past season. Under grazing, especially, a 50 : 50 mixture produced yields that compared favourably with those produced by a pure grass pasture that had received 200 kg of N/ha.

During the period under review a Phase 1 evaluation of introductions was completed in the subintroduction nursery for the bushveld at Vaalharts: The production of certain *Anthephora* selections compared favourably with that of the best *Cenchrus* introductions. Selection V74/103, with a production of 6,42 ton of oven-dried material per ha and selection V74/105, with a production of 6,32 tons/ha, produced over two-thirds of the average production of the best *Cenchrus* introduction. *Anthephora* is not only more cold-resistant than *Ccenchrus*, but also buds earlier in spring. The best *Anthephora* introductions are being transferred to Phase 2.

Kikuyu and annual Italian rye grass are still the most important pasture crops for dairy herds in Natal. The effect of pasture management on the feed flow of these crops was studied in various trials.

Attempts to obtain a twelve-month feed flow from red grass by planting it at montly intervals produced disappointing results owing to weed problems. However, very promising results were obtained by using red grass pastures as an alternative in feedlots where young cattle are being finished for the Christmas market.

FEED AND FORAGE CROPS

Small grain

At Bethlehem winter soilage crops were

selected for yield and regrowth potential with the purpose of identifying suitable cultivars for pasture production. The crops investigated included various oat, wheat, ryecorn, rye grass and even tuber crops. The highest dry matter production was obtained from the oat cultivars. The winter varieties (decumbent) had the best regrowth potential after grazing. Erect cultivars showed little or no regrowth, chiefly because the growing point had been damaged during defoliation. Severe frost also cause damage, particularly to oats. It became apparent from this investigation that oats is suitable for early winter and spring, whereas crops with better resistance to cold, such as rye and wheat, are recommended for the middle of winter. Rye grass produces good yields at the end of winter and can more effectively fill the feeding gap between the end of winter and summer.

Japanese radish

Further work on this well-known crop, and particularly on the Nooitgedacht cultivar, has yielded reliable production standards for seasonal production and quality where Japanese radish is to be included in livestock enterprises. Fertilising calibration work, which started this season, has shown that a balanced NPK fertilising programme is extremely important. Where one or more of these elements are deficient, the result is often total crop failure rather than merely a reduction in yield.

Babala

In a trial in which three overseas babala cultivars *Pennisetum typhoides* were compared with a South African commercial babala in respect of production and chemial quality, the effect of the drought was clearly evident. During the past season Star again produced lower yields than Tamworth, Gahi 3 and SA Standard. The total average dry matter production for the past season was 2,4 tons/ha, however. SA Standard produced the highest dry matter yield throughout.

Cereal legumes

During the year under review seed of the sweet lupin *L. albus* cv. Ultra was multiplied in fields at Rietondale. A good seed crop was obtained and a considerable quantity was sent to the Winter Rainfall Region for further multiplication. This lupin species has good resistance to mildew *Erysiphe* spp., which virtually wiped out the blue lupin *L. angustifolius* in the winter rainfall areas. Large quantities of Ultra seed were also supplied to other Regions for experimental work.

In a yield trial in which several *Lupinus-*, *Vicia-* and *Lathyrus* species and the field peas *Pisum sativum arvense* and *Cicer arietinum* were compared for seed yield, *Lupinus albus* cv. Ultra, with a yield of 3,5 tons/ha, did significantly better than all the other entries. The blue lupin, cv. Unicrop, which produced 1 ton/ha less, was the second best entry.

IV. Agricultural Research Development

RESOURCE CLASSIFICATION

Mapping of land types

Nine land type maps were printed, which means that 15 of the 70 1:250 000 land type maps have now been printed. A further five maps are ready to go to press. These maps cover most of the OFS and Highveld agricultural regions.

A further 13 maps are at an advanced stage of preparation for publication. Researchers are now concentrating on the preparation of the accompanying reports (inventories), the first of which should be ready for publication during 1980.

Peri-urban soil surveys

(scale - 1:50 000)

(a) Pretoria-Witwatersrand-Vereeniging (PWV) area (21 maps) Two maps are being prepared for publication at present, and the fieldwork on a further four has been completed. Preliminary fieldwork has been done on a further 10 maps, but more work is required to enable the maps to comply with all the requirements for the new standard legend which has been finalised for these maps.
Field work is now being geared to the rest of the maps, for which no information is available.

(b) Cape Town-Moorreesburg-Worcester complex (34 maps)

A standard legend has been finalised for these maps. The eight maps for which fieldwork has already been carried out will have to be brought into line with the new legend before fieldwork on the new maps is undertaken.

Irrigation surveys

A detailed study was made of 3 100 ha, and a semi-detailed study of 490 900 ha, for purposes of irrigation development.

DEVELOPMENT OF GOVERNMENT IRRIGATION SCHEMES

Twenty-eight subareas in the Ceres basin and Breede River Valley, with a total area of 226 444 ha, were evaluated with a view to possible irrigation development.

A farm lay-out was finalised for two areas on the right bank of the Orange River below the Vanderkloof Scheme, namely Baviaanskrans and Kalkplaat. The farm lay-out for the Rust and Bleskop areas was completed previously. Preliminary planning for the last area on the right bank, namely Sanddraai, has been carried out.

The assembly of data for the planning of irrigation development in the Sundays River Valley is almost complete and good progress has been made with evaluation.

The evaluation of opportunities for irrigation expansion at the confluence of the Crocodile and Komati Rivers is also progressing favourably.

AGRICULTURAL METEOROLOGY

Agroclimate

The biggest breakthrough during the year under review was the commissioning of the data bank for agricultural meteorology. All sections have the use of the bank, which is used approximately a hundred times a week.

Two new projects were started, namely the mapping of the average monthly rainfall in the Winter Rainfall Region and the division of the Republic into homogenous areas for wheat production.

The agroclimatic study of subtropical crops made such good progress that it was possible to draw preliminary maps for tea and coffee areas. The study of the moisture supply potential has progressed so favourably that models have been developed for maize, wheat and red grass and have been run for a number of meteorological stations.

The topoclimatic study at Douglas was wound up and effective prediction formulas for minimum temperatures were developed.

The influence of weather on crops

The cotton project was continued at Loskop, Vaalharts and Upington. A larger number of cultivars were included and more properties, such as fibre strength, determined.

Techniques for predicting picking ripeness in apples were developed for more cultivars and more areas.

All standard cultivars from the cultivar evaluation programme were included in the study on the influence of the weather on the growth rate of maize. It was found that the duration of sunshine is the best parameter for predicting the period between planting and flowering. The simplification of the 'PUTU' growth model for maize has been completed.

Wind erosion could be so severe that the natural direction in which rivers flow may be threatened. The photograph was taken in the coastal area of the Southern Cape

Improvement of the microclimate

The study on the effect of windbreaks on the yield and quality of oranges was concluded. It was found that the wind climate of the cultivation area plays a big part in determining whether it is really economic to put up windbreaks or not. Seven years' data for the microclimatic study of the Theewaterskloof Dam site have now been assembled.

IRRIGATION RESEARCH

Lysimeter studies for determining the water requirements of crops in relation to soil, planting and atmospheric conditions were continued at Roodeplaat and Addo. Wheat in rotation with soya-beans was studied at Roodeplaat, and the requirements of citrus orchards were comprehensively investigated in the Sundays River Valley. These projects comprise the intensive assembly of data which, upon processing, reveal basic relationships which have a practical application in that it becomes possible to make a better estimate of the water requirements of crops for purposes of planning or management. Research results were formulated in several articles during the past year and submitted for publication.

An investigation to establish the relationship between the water quota applicable on Government water schemes and the incidence of waterlogging and brackishness was launched. The programme includes the taking of readings on plots on the schemes in order to evaluate irrigation practices against soil moisture and yield norms developed from research. The water:yield function for wheat is an example of such a norm; it was corroborated during the past year by further data from irrigation trials.

Chemical interaction between soil and water

The attempt to calculate the contribution of irrigation backflow to the mineralisation of the Great Fish River with the aid of a mathematical simulation model was continued. In conjunction with a model being developed by the National Institute for Water Research attached to the CSIR , this model describes the hydrology of the river system and the contributions of various activities to the salt load in the river. According to preliminary results for part of the river, irrigation backflow appears to make an important contribution to both the volume of water and the quantity of dissolved salts in the river.

The development of a similar irrigation backflow model to determine the contribution of irrigation in the Breede River Valley between the Brandvlei Dam and Robertson to mineralisation of the Breede River has been started. In this case the hydrological model is being developed by the Department of Water Affairs.

Soil fertility studies

Work continued on the development and refinement of methods to form the basis for practices for correcting the soil fertility and plant nutrition studies of soils and plants for particular soil/water/climatic combinations. It was established that a large percentage of the work done at present by various laboratories in order to supply advice on phosphorus fertilising is based on methods which are frequently not suitable for the purpose.

Good progress was made with several important aspects of the co-ordination of, and research on, fertilising advisory services for farmers. Work continued on the standardisation of the terminology for, and the use and interpretation of

soil and plant analyses, and on the amendment of Act 36 of 1947, which governs the registration and control of fertilisers. An internal progress report from the Department's fertilising advisory services, reflecting the progress made and the efficiency of the services, was published.

On the basis of the available information, the analysis of soil samples, pot trials and a summary of the fertilising advisory services and analytical reports, the determination and monitoring, on a national basis, of the soil fertility status of the Republic's soils were continued.

Research carried out on the effect of growth inhibitors that occur in wheat straw provided valuable information on the root and vegetative growth of plants and the development of populations of micro-organisms in soils.

USE OF FERTILISER

During 1978, 2 727 553 metric tons of fertiliser was used for the growing of agricultural crops. This figure includes 379 071 tons of nitrogen, 177 691 tons of phosphorus and 108 048 tons of potassium.

1 193 821 metric tons of agricultural lime and other types of lime was used to counteract soil acidity.

OTHER SOIL AND WATER STUDIES

Soil mineralogy and chemistry

The soil mineralogical and chemical analytical programme on soil samples from the Natural Resources Survey was continued. Clay and silt fractions from a further 800 samples were isolated.

Soil physics

Every effort was made to process the large amounts of data obtained from the Natural Resources Survey and examine the broad physical properties of soil materials reflected in this data. Structural stability and soil:water relationships were examined in detail.

Progress was made in the use of generalised equations relating water retention and hydraulic conductivity of soils. Approximate values of the constants in these equations should be available soon for various soil types.

The use of these equations in computer models describing the movement and physical behaviour of water in soil was improved.

Several improvements to analytical techniques were tested. One example is elutriation as an aid to particle size analysis and another the approximate determination of unsaturated hydraulic conductivity.

SOIL CONSERVATION

If one takes into account the fact that about 400 million tons of soil is washed away in the rivers of the Republic annually, the necessity for statutory measures to counteract the deterioration of the soil as far as possible becomes evident.

Reclamation of a drift sand area in the South Eastern Cape by the establishment of such crops as seawheat, marram grass, wax berry, bitou and cancerbush (keurtjie)

Severe soil erosion in pineapple lands where no provision was made for the control of water-flow. In the Eastern Cape Region increasing attention is being paid to water run-off control planning

(a) Protection of agricultural land

With a view to protecting our natural resources, *inter alia* by promoting conservation practices in farming, the Government has paid over R54 000 000 in subsidies since 1948 for completed soil conservation works in the Republic.

From 1970 to the end of 1978 over R45 million was paid to farmers under the Stock Reduction Scheme. This Scheme has now been wound up.

TABLE 1 - Kinds of work subsidised and amounts paid in the Republic of South Africa

	1978/79	1977/78
	R	
Inner camp fencing	830 112	2 614 910
Stock-watering points	735 359	2 103 946
Soil reclamation (erosion) fences	50 248	313 679
Soil conservation works	689 078	557 925
Contour banks	1 035 719	649 713
Brack control	587 508	948 804
	3 928 024	**7 188 977**

It is notable that there was a big decrease in subsidy grants last year in comparison with the previous year. Several reasons may be advanced for this. The widespread drought, the high inflation rate, high fuel prices, and the reduction of subsidies on grazing utilisation works (camp fences and stock-watering points) to 25 per cent.

The last-mentioned factor was also largely responsible for making the physical planning of farms less attractive, as Table 2 shows.

Tables 1 and 2 indicate a decrease in the physical planning of farms and related activities. What is encouraging, however, is that the protection of lands appears to be receiving the attention it deserves. Run-off control planning

TABLE 2 - Planning of farms

Region	New plans		Replanning and supplementary planning	
	1977/78	1978/79	1977/78	1978/79
Karoo	258	234	462	348
Eastern Cape	69	65	503	484
Natal	58	44	222	127
Free State	219	160	663	551
Winter Rainfall	132	66	591	316
Highveld	205	192	255	301
Transvaal	320	238	183	198
	1 261	**999**	**2 879**	**2 325**

appears to be enjoying increasing attention in the regions.

For instance, during the year under review R176 500 was paid to farmers in the Highveld Region for the building of waterways and almost R33 000 was spent on contour banks.

A great deal of attention was paid to run-off control planning in pineapple lands in the Eastern Cape Region and to waterways and brack drainage systems in the Winter Rainfall Region. In the latter Region the number of waterways increased by 52 % and the number of brack drainage systems by 28 %.

(b) Statutory control

During the year under review the inspection service of the Division of Soil Protection referred a slightly larger number of alleged contraventions of the Soil Conservation Act than during the previous year. Although 301 problem cases were dealt with without legal action being taken, 328 new cases were added. The total number of cases pending is 1 792 at present.

It is the policy of the Division to try to persuade persons suspected of contravening the Act

TABLE 3 - Prosecutions under the Soil Conservation Act from 1969 to 30 June 1979

Period	Contraventions referred to the Attorney-General	Prosecutions instituted	Convictions
1969-1978	47	32	30
1978-1979	2	1	1
	49	33	31

to rectify any malpractices before recourse is had to legal action.

(c) Soil conservation committees

The Minister of Agriculture, in consultation with Organised Agriculture, reappointed the serving soil conservation committee members for a further period of a year, up to 30 September 1980. This additional period of office was considered necessary during the transitional period after the establishment of new committees with broader functions.

(d) Preservation of agricultural land

The Subdivision Section of the Division of Soil Protection is responsible for the administration of the Subdivision of Agricultural Land Act.

The activities of the Section revolve mainly around the handling of applications for the subdivision of agricultural land, the vesting of undivided shares, township development, incorporation into areas of jurisdiction of municipal and similar bodies, leases and the registration of servitudes.

The following tables indicate the number of applications dealt with under the Subdivision of Agricultural Land Act.

Permission to subdivide agricultural land inevitably means an increase in the number of farms. On the other hand every effort is being made to consolidate smaller farms in order to turn them into viable farm units.

TABLE 1(a) - Applications for subdivision, vesting of undivided shares, township development and incorporation into areas of jurisdiction of municipal and similar bodies

Period	Approvals Number	%	Rejections Number	%	Total
1971-01-02 to 1977-06-30	4 694	75	1 556	25	6 250
1977-07-01 to 1978-06-30	551	76	177	24	728
1978-07-01 to 1979-06-30	585	81	137	19	722
Total	**5 830**	**76**	**1 870**	**24**	**7 700**

TABLE 1(b) - Applications in respect of leases and servitudes

Period	Approvals Number	%	Rejections Number	%	Total
1971-01-02 to 1977-06-30	341	96	16	4	357
1977-07-01 to 1978-06-30	53	96	2	4	55
1978-07-01 to 1979-06-30	62	97	2	3	64
Total	**456**	**96**	**20**	**4**	**476**

TABLE 2 - Subdivisions for agricultural purposes only

Period	Approvals Number	%	Rejections Number	%	Total
1971-01-02 to 1977-06-30	3 807	82	840	18	4 647
1977-07-01 to 1978-06-30	434	76	134	24	568
1978-07-01 to 1979-06-30	495	81	98	19	593
Total	**4 736**	**82**	**1 072**	**18**	**5 808**

Table 3 shows the situation to date.

That there was a far bigger drop in the number of owners is apparent from the data recorded, according to which 834 owners left the

The aim of all soil conservation and soil protection works is a well cared for, stabilised soil on which optimal production of plant and animal can be obtained

VERKLARING LEGEND

STREKE REGIONS

Winterreën	1	Winter Rainfall
Oos-Kaap	2	Eastern Cape
Karoo	3	Karoo
Natal	4	Natal
Oranje Vrystaat	5	Orange Free State
Hoëveld	6	Highveld
Transvaal	7	Transvaal
Voorligtingswykkantoor	●	Extension Office
Substreekkantoor	★	Sub Regional Office
Streekkantoor met Wykkantoor	●	Regional Office with Extension office
Streekgrense	▬	Regional Boundaries
Substreekgrense	—	Sub Regional Boundaries
Voorligtingswykgrense	—	Extension Area Boundaries

RHODESIË RHODESIA

MOSAMBIEK MOSAMBIQUE

BOTSWANA

SUIDWES-AFRIKA SOUTH WEST AFRICA

LESOTHO

SWAZILAND

TRANSKEI

CISKEI

MESSINA SIBASA SOUTPANSBERG LOUIS TRICHARDT ELLISRAS PIETERSBURG TZANEEN LETABA THABAZIMBI MYLSTROOM WARMBAD WATERBERG POTGIETERSRUS PILGRIM'S REST LYDENBURG GROBLERSDAL MARICO ZEERUST VRYBURG MAFEKING KURUMAN GORDONIA POSTMASBURG UPINGTON KENHARDT SPRINGBOK NAMAKWALAND PRIESKA HOPETOWN HERBERT KIMBERLEY B.-OEMFONTEIN FAURESMITH EDENBURG TROMPSBURG SMITHFIELD ZASTRON PHILIPPOLIS PHILIPSTOWN BRITSTOWN DE AAR CARNARVON WILLISTON VANRHYNSDORP CALVINIA VICTORIA WEST RICHMOND COLESBERG VENTERSTAD HANOVER NOUPOORT STEYNSBURG ALBERT MIDDELBURG MARAISBURG MOLTENO DORDRECHT NOWE ELLIOT FRASERBURG MURRAYSBURG GRAAFF REINET BEAUFORT WEST SUTHERLAND ABERDEEN PEARSTON CLANWILLIAM PIKETBERG CERES MORREESBURG MALMESBURY LAINGSBURG PRINCE ALBERT WILLOWMORE JANSENVILLE OUDTSHOORN GEORGE KNYSNA HUMANSDORP MONTAGU ROBERTSON CALEDON SIMONSTOWN BREDASDORP RIVERSDALE HERMANUS HEIDELBERG SWELLENDAM MOSSEL BAAI UNIONDALE HANKEY PORT ELIZABETH ALBANY GRAHAMSTOWN PEDDIE BEDFORD SOMERSET EAST QUEENSTOWN KOMGA WILLOW VALE ELLIOTDALE NOMAHEKI NGQELENI PORT ST JOHNS LIBODE TSOLO LUSIKISIKI BIZANA OUMBU MACLEAR BARKLY EAST ALIWAL NORTH GREY MATATIELE MOUNT FLETCHER HERSCHEL KOKSTAD MOUNT FRERE MOUNT AYLIFF FLAG STAFF TABANKULU IXOPO UMZIMKULU UMLAZI DURBAN ESHOWE GREYTOWN LOWER UMFOLOZI NONGOMA ONGOTSHE VRYHEID PIET RETIEF WARKERSTROOM STANDERTON BETHAL ERMELO BARBERTON W. RIVER LOURENCO MARQUES INGWAVUMA JOZINI

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES
REGIONS ,SUB-REGIONS AND EXTENSION AREAS
30 th June 1973

REPUBLIEK VAN SUID-AFRIKA
DEPARTEMENT VAN LANDBOU-TEGNIESE DIENSTE
STREKE ,SUBSTREKE EN VOORLIGTINGSWYKE
30 Junie 1973

16° 18° 20° 22° 24° 26° 28° 30° 32°

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Trigonometrical Survey Office 1951 Revised 1972
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TABLE 3 - Number of farm units created and number of farms and areas of farms consolidated with other properties, 1971-01-02 to 1979-06-30

Period	New farm units created	Consolidations Number of farms	Area
1971-01-02 to 1977-06-30	961	2 621	974 000
1977-07-01 to 1978-06-30	96	360	287 018
1978-07-01 to 1979-06-30	110	377	170 479
Total	**1 167**	**3 358**	**1 432 429**

industry and 377 properties disappeared during the year. These results may be ascribed to the fact that properties are jointly owned and on consolidation the number of properties is greatly reduced.

Subdivision of agricultural land for non-agricultural purposes

In Table 4 the applications for subdivision for non-agricultural purposes are divided into two groups, namely -

(i) applications for extensive occupation, business purposes, resorts and mining operations, and

(ii) applications for intensive urban use.

The number of applications for extensive occupation, business, resorts and mining was slightly lower than during the previous year. It is gratifying to report that only 732 ha was set aside for this purpose.

The applications (48) for intensive use were all approved, which more than doubled the area set aside for this purpose in comparison with the previous year.

The fact that an increasing percentage of the limited amount of agricultural land available is being used for intensive urban use is disquieting.

The biggest single application related to Sishen and Kathu, where 40 307 ha was involved. The area has a fairly low agricultural potential.

Officers of the Division of Soil Protection represent the Department of Agricultural Technical Services on the Planning Advisory Council to the Prime Minister's Subsidiary Committee for the Disposal of State Land. Numerous inspections of agricultural land to be set aside for new roads, railways, defence purposes, Armscor and nature conservation were undertaken.

WEED CONTROL

Jointed cactus

Since 1957 the State has spent about R10,2 million on spray for the control of jointed cactus. This does not include salaries and wages, or subsistence and travelling costs, or the sums spent by farmers themselves. Inspection reports indicate that progress is being made in controlling this weed, but there is as yet no question of complete eradication.

The Stock Reduction Scheme, which included large portions of the inspection area, hampered the jointed cactus campaign in certain respects because the weed became invisible in places as a result of the good veld cover. Some farmers left their farms and jointed cactus control was neglected.

Nassella tussock

This extremely dangerous weed has already penetrated large areas of the Eastern Cape and Karoo Regions.

In the Somerset-East, Pearston and Graaff-Reinet districts of the Karoo Region infestations occurred on 67 farms. A large area is lightly infested, but 1 500 ha is already heavily infested.

The campaign against this weed is being tackled in two ways: Some farms are sprayed by the State and further control is then left to the farmers.

On other farms, where infestations are light, the farmers have to do their own spraying and the spray is subsidised.

State teams sprayed about 111 ha from 26 February 1979 to 30 June 1979 and cleared the weed from 98 ha by physical means. The average cost per ha was R140. Farmers are increasingly coming to realise the gravity of the problem.

Control was started in the Eastern Cape Region in November 1978. By the end of June 1979 State teams had sprayed 507 ha and cleared a further 85 ha. Of the 41 000 ha in the Eastern Cape infested with Nassella tussock, 31 000 ha or about 75 % is under control.

Additional plants declared weeds

The following plants were declared weeds during the year under review: *Pereskia aculeata* Barbados gooseberry, *Pereskia grandiflora* large-flowered Barbados gooseberry *Sesbania punicea* red sesbania.

TABLE 4 - Subdivision for non-agricultural purposes: Number of applications and area involved

Period	(i)Extensive occupation, business, resorts and mining						(ii) Intensive urban use					
	Approved			Rejected			Approved			Rejected		
	Number	%	ha	Number	%	ha	Number	%	ha	Number	%	ha
1971-01-02 to 1977-06-30	574	49	21 027	589	51	40 853	442	92	96 093	36	8	6 083
1977-07-01 to 1978-06-30	59	57	2 097	45	43	777	40	100	22 985	0	0	0
1978-07-01 to 1979-06-30	52	57	732	39	43	1 369	48	100	54 867	0	0	0
Total	**685**	**50**	**23 856**	**673**	**50**	**42 999**	**530**	**94**	**173 945**	**36**	**6**	**6 083**

V. Entrepreneur Development

AGRICULTURAL EXTENSION SERVICES

The regional organisations of the Department are responsible for the promotion of agricultural development, in co-operation with producers.

This task is performed by the extension staff of the regional organisations, working through the medium of general group activities and committees and study groups.

GROUP ACTIVITIES

Table 1 contains a résumé of the combined activities of the seven regional organisations of the Department.

It is evident from Table 1 that the number of group activities arising from a formal extension programme is lower than the number of *ad hoc* activities.

Programming has always been the preferred extension method, despite the tremendous pressure of work caused by *ad hoc* tasks and requests to the extension staff.

The number of farmers' days held and courses presented for farmers indicates that activities of this kind still take place chiefly on an *ad hoc* basis.

The 1 113 programme-directed group activities (P) were attended by 11 803 persons. The 904 *ad hoc* group activities (A) were attended by 19 099 persons. These statistics clearly show that programme-directed activities provide more intensive contact and apparently also create a better learning situation.

Regional reports on group activities

The practice of commenting on only a few regional organisations has been followed in this report. These comments illustrate exceptional developments or achievements in particular fields.

HIGHVELD REGION

Owing to the demands of programme planning, extension staff are compelled to make less use of individual visits as an extension method and to concentrate on group activities. At present especial value is attached to study groups as a channel of communication through which knowledge can be disseminated and farmers persuaded to put new knowledge into practice.

The Highveld Region is devoting a great deal of attention to training farmers to classify soils and distinguish between various potential classes. During the year under review 33 short courses, geared chiefly to soil classification, the re-classification of land units, suitable crop choice and fertilising according to yield potential, were presented. These courses were attended by 537 participants.

COMMITTEES AND STUDY GROUPS

Committees and study groups constitute a very valuable extension medium and one which extension staff make use of in a variety of fields.

Table 2 shows the kinds of committees that operated and the subjects that received attention during the year under review.

Table 2 reflects a total of 258 formally constituted study groups, with a membership of 2 774. Forty-four of these study groups were used as programme planning committees as well.

It is noteworthy that 192 soil conservation committees also act as programme planning committees.

TABLE 1 - Group activities

Activity		Number		Total attendance figure or number of collaborators		Number of lectures given by extension staff	
		*P	*A	*P	*A	*P	*A
(a)	Farmers' days held	56	152	3 055	8 376	82	204
(b)	Courses presented for farmers	32	47	471	1 086	126	62
(c)	Demonstrations held	88	81	1 124	1 147	63	70
(d)	Study group meetings	381	34	3 227	4 100	242	202
(e)	Soil conservation committee meetings	362	341	1 816	2 219	159	240
(f)	Exhibitions held by extension staff	7	4	72	187	1	2
(g)	Farming competitions held	19	47	141	278	7	2
(h)	Meetings arranged with regard to (g)	16	17	508	288	44	9
(i)	Co-operative trials/demonstrations	88	93	94	264	18	11
(j(	Meetings arranged with regard to (i)	38	49	964	802	38	131
(k)	Practical studies (Yield standards and production techniques) in progress :						
(l)		16	22	173	68	2	5
(l)	Meetings arranged with regard to (k)	1 010	17	158	284	4	104
		1 113	904	11 803	19 099	786	1 042

* P = activities that appeared on the work calendar of an extension programme
* A = *ad hoc* activities that did not form part of the work calendar of a programme

TABLE 2 - The activities of committees and study groups

Subject	Study groups per subject A			Soil conservation committees per subject B		Other programme planning committees C	
	Number of active study groups	Total number of members of active study groups given under A(a)	Number of active study groups given under A(a) acting, *inter alia*, as programme planning committees	Number of soil conservation committees acting as programme planning committees	Number of members	Number of other programme planning committees not given under A or B	Number of members
	(a)	(b)	(c)	(a)	(b)	(a)	(b)
Pastures	30	323	-	40	94	-	-
Beef cattle	10	150	1	-	-	-	-
Dairy cattle	8	65	-	1	6	-	-
Sheep	6	55	-	6	57	-	-
Other livestock	3	44	-	-	-	-	-
Soil	7	80	3	1	12	-	-
Irrigation	5	42	4	40	-	-	-
Horticulture	18	260	1	-	-	-	-
Agronomy	54	802	5	10	73	3	42
Economics	108	884	30	41	10	-	-
Soil conservation	4	28	-	46	326	1	8
Other	5	41	-	7	50	5	33
	258	**2 774**	**44**	**192**	**628**	**9**	**83**

EXTENSION PROGRAMMES

The endeavour of the Departmental extension service to promote optimum land use is given practical application in the extension programme.

Fundamentally there are two approaches, namely the identification of homogeneous farming areas within which a programme is carried out and the selection of a target audience with whom a programme is carried out.

Table 3 shows the scope of these activities.

Programmed extension - highlights

WINTER RAINFALL REGION

Contour programmes

In the South Coast Subregion 866 km of contour banks was completed - 146 more than the target for the year, which was 770 km.

Contour programmes went off very successfully in the Swartland as well. 1 748 km contour banks and 71 waterways were completed in this Subregion; in the Koringberg area 100 % of the 4 000 ha of sloping lands which constituted the target has now been protected by means of contour bank systems.

Dosing programme for ostriches

A systematic dosing programme for ostriches has been successfully launched by means of an extension programme. At present 94 % of ostrich farmers are dosing their flocks and using only registered preparations for the purpose.

Chicks, which are the most susceptible to internal parasites, are being dosed an average of six times at present, whereas chicks used to be dosed only twice. Where only 15 % of farmers dosed their plucking stock in 1976, this practice has now been adopted by 45 %. A new dosing method, namely the administration of 2 dosing preparations

TABLE 3 - Scope of extension programmes within fairly homogeneous areas or directed at target audiences

	*Fairly homogeneous areas with programmes		**Target audiences with programmes	
Number of areas or target audiences with programmes		52		649
Area involved (ha)		6 786 815		2 593 970
Area of land or veld mapped during the year under review (ha)	*Land*	32 896 ha	*Land*	713
	Veld	339 490 ha	*Veld*	-
Works surveyed during the year under review		22		0
i) Waterways (ha)		1 242,8		131,8
ii) Contours (km)		1 319,37		3 318
iii) Other erosion works (number)		102		58
iv) Stock-watering points (number)		250		223
v) Other: Site surveying		17 000 ha		86
Earth dams		87		-

* Fairly homogeneous areas, for the purposes of this report, are target areas, priority areas, development areas, etc., which are fairly homogeneous and for which development or run-off control plans have been drawn up and are being carried out.

** A target audience, for the purposes of this report, is a specific group of farmers to whom a particular message of common interest is directed but who do not live in a particular fairly homogeneous area, (e.g. dairy, pig, or chicken farmers in a district/districts.

simultaneously in order to cut down on the handling of the animals, has rapidly become accepted and is applied by 78 % of the farmers.

HIGHVELD REGION

Extension programmes were expanded during the year under review in order to include larger numbers of farmers within extension wards. Extension areas that are fairly homogeneous in respect of the resources of soil and climate were demarcated and communities within these areas were involved in extension programmes by means of study groups.

An attempt was made to avoid confining extension programmes to progressive farmers. When the message was formulated particular attention was paid to practicability and clarity, so that it would be acceptable to the average group of farmers as well.

NATAL REGION

During the year under review the regional programme for the protection of lands in the Natal Region was converted, most profitably, to the new run-off control programme, which now comprises operations in 13 extension wards. The Natal Region has made considerable progress in bringing lists of addresses of all farmers, including Indian farmers, up to date for the computer programme for the farming situation survey "Agriquest".

This programme will be used to determine and re-evaluate the Region's research and extension priorities and to give the regional development programme greater impact with regard to programmed extension.

Ad hoc advisory and miscellaneous services - highlights

WINTER RAINFALL REGION

Soil fertility trends, which have been compared over the past four years, show remarkable similarities from year to year.

One of the most important conclusions reached is that about 60 % of the soil samples show a phosphorus content of over 30 ppm. Above this value only maintenance fertilising levels are required. Data from the mail-in record system clearly showed that there is a general trend among farmers to apply too much phosphatic fertiliser to winter cereals.

Seventeen lectures to farmers' groups in the Region were devoted to this matter. This encouraged farmers to replan their fertilising programmes, which made significant cuts in the production costs of winter cereals possible.

KAROO REGION

Farm planning

During the year under review 234 farms were planned for the first time, and 348 were replanned.

Soil conservation

The conservation condition of large areas of the Karoo Region, particularly the watercourse fields, has improved notably. According to the Department of Water Affairs the silt flow to the Lake Mentz Dam has decreased by 40 % since 1946 - evidence that extension has largely succeeded in persuading the farmers in the catchment area to apply more efficient conservation practices.

TRANSVAAL REGION

In the Nylstroom Extension Ward sunflower seed, maize and groundnut yields were very successfully boosted on a number of farms. Attention is now being given to other crops such as soya-beans and castor oil, instead of wheat monoculture, which is particularly common on the Springbok Flats.

There has been good progress with farm planning at Thabazimbi during the past few years. About 75 % of all farms have already been planned.

NATAL REGION

More than twice the amount of *ad hoc* advice on vegetables and subtropical fruit was given in the Coastal Subregion during the past year. The area under these crops has increased by over 1 000 % during the past 3 years.

In certain parts attention was given mainly to the owners of small holdings, especially those engaged in banana growing. In all 101 soil samples were taken on small holdings during the past year.

TRENDS IN AGRICULTURE

Agriculture is a dynamic industry. Consequently the extension service has to be constantly on the alert for change, and for any alteration in the needs of the farming community. A few trends experienced during the year under review are outlined in brief.

WINTER RAINFALL REGION

Swellendam

Dairy farming is becoming an increasingly important enterprise on irrigation farms and vegetables are being replaced by cultivated pastures owing to the instability of the market.

Riversdale

Cultivated legume pastures are replacing wheat culture on low-potential and sloping soils. Pastures are replacing certain irrigated crops and dairy cattle are being included. The practice of allowing lands to lie fallow is dying out, and being replaced by the cultivation of short-rotation legume pastures.

Caledon

Industrial milk producers are showing an unmistakable tendency to switch to fresh milk production for the Cape Town area. The traditional fallow system is being challenged and many farmers are switching to the cultivation of legume pastures, in past at least.

KAROO REGION

The big increases in fuel and implement prices are causing farmers to switch from lucerne production to the production of grass clover pastures that can be grazed. This trend is especially evident in the Magisterial Districts of Colesberg and Cradock.

In the Bokveld and Roggeveld areas of the Magisterial District of Calvinia farmers are changing over to larger plantings of annual clovers because the cost of cultivating croplands has risen enormously.

FREE STATE REGION

There has been a change-over from lucerne to field crops and vines in the Lower Orange irrigation area. Interest in cotton and peas is also increasing.

In the *Vaalharts irrigation area* there has been a switch from seed potato production to the production of cotton and groundnuts. Dairy farming is being expanded, and there has been a decrease in the planting of sunflowers.

In the *South-Eastern Free State* the planting of annual fodder crops, especially lucerne, has increased. Only high-potential soils are used for cash crops, as a result of the high cultivation costs.

HIGHVELD REGION

Farmers are increasingly realising the value of knowledge of soil as a resource, with the result that the demand for training in soil classification is continuing to increase. During the year under review 19 courses on soil classification were presented; they were attended by 288 farmers. This enabled farmers, with very little assistance, co-ordination and supervision from field officers, to classify field husbandry soils with a total area of 41 720 ha on 71 farms.

Low-potential soils are increasingly being withdrawn from cash crop cultivation and used for the cultivation of fodder and perennial pasture crops.

The area under grain sorghum and sunflowers is continuing to increase. This may be ascribed to the fact that these crops do better on low-potential soils than crops like maize.

TRANSVAAL REGION

Northern Transvaal Subregion

Cattle farmers are beginning to pay more attention to steer and ox production, at the expense of weaner calf production. There has also been a sharp drop in the production of small stock, especially goats, in this subregion.

Central Transvaal Subregion

There has been an increase in dairy and sheep farming in this subregion and a decrease in beef production. Less groundnuts, grain sorghum and sunflowers are being grown, but the cultivation of grapes is increasing.

Eastern Transvaal Subregion

There was an increase in the areas under avocados and bananas in this subregion. Fewer vegetables were planted, chiefly as a result of price fluctuations and high fuel prices. The use of insecticides is gaining ground rapidly.

Western Transvaal Subregion

Owing to the high chlorine content of irrigation water from the Hartbeespoort Dam, farmers are switching from tobacco to vegetables, soya-beans and wheat. Lucerne plantings under irrigation at Brits are increasing, and soya-bean cultivation in the Marico district is also increasing.

South-Eastern Transvaal Subregion

Milk production and woolled sheep farming is increasing in the South-Eastern Transvaal at the expense of beef cattle farming. Farmers are showing an encouraging tendency to start relating the yield targets for field crops to soil potential.

NATAL REGION

Maize production is being intensified and both horizontal and vertical expansion are receiving more attention.

The tendency for both beef cattle and sheep farming to become more extensive, with greater emphasis on veld grazing, is continuing. There is a tendency for beef cattle farmers and fresh milk farmers to switch to industrial milk production. There is also a tendency for dairy farmers to switch to sheep and beef cattle, owing to the higher cost of bought concentrates.

Larger areas are being planted to cotton in the Weenen, Winterton and Harding districts, and coffee cultivation is increasing in the coastal areas.

Banana growing is still increasing in the subtropical parts of Natal. What is particularly striking is the fact that there has been an increase in the number of larger farms on which bananas are grown.

There has been an increase of almost 200 % in Cayenne plantings in the Hluhluwe area, although the plantings of Queen pineapples have shown little expansion.

EASTERN CAPE REGION

In the Adelaide, Fort Beaufort and East London districts farmers are running more Boer goats in order to improve the utilisation of shrub and brush.

The cultivation of perennial fodder crops is rapidly gaining ground at Dordrecht and Indwe. Farmers at Alexandria are switching from chicory to wheat and pastures.

TRAINING AT COLLEGES OF AGRICULTURE

The Department is responsible for the training of prospective farmers at colleges of agriculture. There are five colleges, situated at Cedara (Natal), Elsenburg (Stellenbosch), Grootfontein (Middelburg, Cape), Glen (Bloemfontein) and Potchefstroom (Transvaal).

Table 4 gives particulars of student numbers for the year under review and the previous years.

Short courses

The colleges of agriculture play a valuable part as an information centre for farmers in the area served. The scope of the short courses for farmers presented at colleges of agriculture during the year under review is reflected in Table 5.

TABLE 4 - Particulars of students

	Student numbers[1]			
	Juniors		Seniors	
	1978/79	1977/78	1978/79	1977/78
Number of students	335	374	294	213
Number resident	305	355	268	184
Number not resident	30	19	26	29
Number of passes	-	286	282	274
Number of failures	-	59	13	2
Number:				
Afrikaans-speaking	221	243	197	143
English-speaking	110	131	94	67
Foreign	4	-	3	3

TABLE 5 - Short courses presented at colleges of agriculture

Subject of short course	Number of courses	Number of attendants
i) Sheep and wool and wool classing	13	283
ii) Dairying, feeding, dairy cattle, cream testing, milk grading	12	418
iii) Beef cattle farming, Afrikaner cattle judging	3	147
iv Artificial insemination	20	340
v) Farming business management	1	17
vi) Mechanisation, welding, tractor repairs	4	48
vii) Grazing, feed planning, soilage cultivation	5	263
viii) Soil classification, cultivation, drainage	3	48
ix) Maize, dry beans, grain sorghum, grain grading	9	324
x) Pig farming	1	83
xi) Angora goats	1	20
xii) Sundry	2	101
Total	**75**	**2 092**

AGRICULTURAL INFORMATION SERVICES

POPULAR PUBLICATIONS

Altogether 221 new leaflets with a total impression of 1 104 000 copies were printed and distributed during the year. A further 126 leaflets with a total impression of 297 000 were reprinted to supply in the demand for existing series. Leaflets are distributed on a fixed basis according to a computerised mailing list which at present contains about 62 000 names.

Other publications printed and distributed were: 162 500 copies of the weekly newsletter, *Agricultural News*, 40 300 copies of *Agricultural Reports*, 51 500 copies of local newsletters, 29 000 copies of lectures, library lists and manuals, 70 000 copies of test results on egg-laying tests, milk records as well as various agricultural implements which included micro-sprays, augers, cattle scales, tractor power and molasses mixers.

During the year under review a series of leaflets on fuel saving and sheep-scab control were also prepared and printed. The total impression came to about 1 250 000.

Other regular publications that were prepared and printed were Pesticides and Fungicides, Agricultural Research and Agricultural Review as well as the departmental annual report. The following publications were prepared for printing for the Department of Aricultural Economics and Marketing: departmental annual report, two editions of Trends in the Agricultural Sector and four editions of Agrekon in both Afrikaans and English.

SCIENTIFIC PUBLICATIONS

Agroplantae, Agroanimalia, Agrochemophysica, Phytophylactica

During the year under review 83 articles were received, one less than the previous year. Together with 72 articles that were carried over from the previous year, 155 articles were dealt with. Eighty-five of these were approved, 55 are still being considered, six were rejected, four scratched, four withdrawn and one incorporated with another article.

A committee was appointed to investigate and make recommendations about the continued publication of the journals.

Onderstepoort Journal of Veterinary Research

Four issues appeared during the year under review, namely Volume 45(3), 45(4), 46(1) and 46(2).

Thirty-six contributions were received during the year under review and the same number published.

Other scientific publications

Other scientific publications which appeared are the following:

Flowering Plants of Africa, vol. 45 parts 3 and 4; Botanical Survey Memoir, no. 43; Bothalia, vol. 11 no. 4; Entomology Memoir, no. 48, 49 and 50; Technical Communication, no. 142, 147, 150, 151, 152, 153, 154, 155 and 156.

Eighteen articles were prepared for printing and publication in the SA Forestry Journal for the Department of Forestry.

AUDIO-VISUAL SERVICES

During the year under review 18 synchronised slide programmes were completed. The commentary was prepared for printing in both languages, was sound-tracked on master tapes and then recorded on cassettes. A further 22 slide programmes are being prepared.

Different programmes were lent out on 376 occasions and 45 programmes were issued permanently. A number of non-departmental institutions purchased programmes.

The activities of the Photographic Section increased considerably due to the closing down of the National Film Board and a large number of photographs were taken and printed, both in black and white and in colour.

Assistance was rendered to various institutions, mainly with the preparation of photographic material for exhibitions.

A permanent exhibit was prepared for display in the Stock Exchange Building in Johannesburg, while the permanent exhibition in the Didacta Building in Pretoria is being renovated.

CALLING ALL FARMERS

There was a renewal in the way in which programmes for and about agriculture were offered to listeners during the past year. Priority was given to short contributions on topical matters in an attempt to cover a wider field and to come closer to the crux of the requirements, problems and events in the agricultural industry.

The fuel crisis and serious droughts in various parts of the country made a very clear impact on the programmes. Reports about these crises and information on how to alleviate them were contained in at least one-third of all broadcasts.

Moreover, Calling All Farmers played an invaluable role in the success of the fuel saving campaign launched by Organised Agriculture, the Department of Agricultural Technical Services and the private sector.

The significance of Health Year for the rural areas similarly received considerable attention and

discussions concerning this matter during symposia on agricultural science subjects were reflected in the programmes.

AGRICULTURAL NEWS

Both the appearance and the contents of Agricultural News were improved considerably during the year under review. Improvements with regard to the typographical lay-out of the newsletter as well as improved printing facilities at the Division of Agricultural Information meant that the general appearance of the newsletter could be improved.

Editorially more intense attention was paid to the gathering of news and information from the wide spectrum of activities of the three Departments of Agriculture.

Researchers, extension officers and other officers make increasing use of the newsletter as an important news medium and, in the wider sphere, much more use was made of reports from the newsletter in, particularly, agricultural journals which appear weekly, the rural press and in SABC news-bulletins.

The activities and findings of the departments of agriculture enjoy tremendous publicity through this wide range of news media.

CENTRAL AGRICULTURAL LIBRARY

The most important change in the agricultural library service during the past year was the abolition of the loan service to farmers.

In consultation with the Library Committee, the Library decided that from 1 May 1979 onwards farmers and other private members would no longer be permitted to borrow books directly from the Central Library, but would have to borrow through the agency of their local public library, through the interlibrary loan system.

The excellent service provided by the Division of Agricultural Information through its pamphlets should meet the needs of most farmers. Those who wish to read more widely can keep abreast of available literature through AGROLIBRI and obtain books through their local public library on interlibrary loan from the Central Library or its branch libraries. It was therefore decided to expand the content of AGROLIBRI and to include new accessions to the branch libraries.

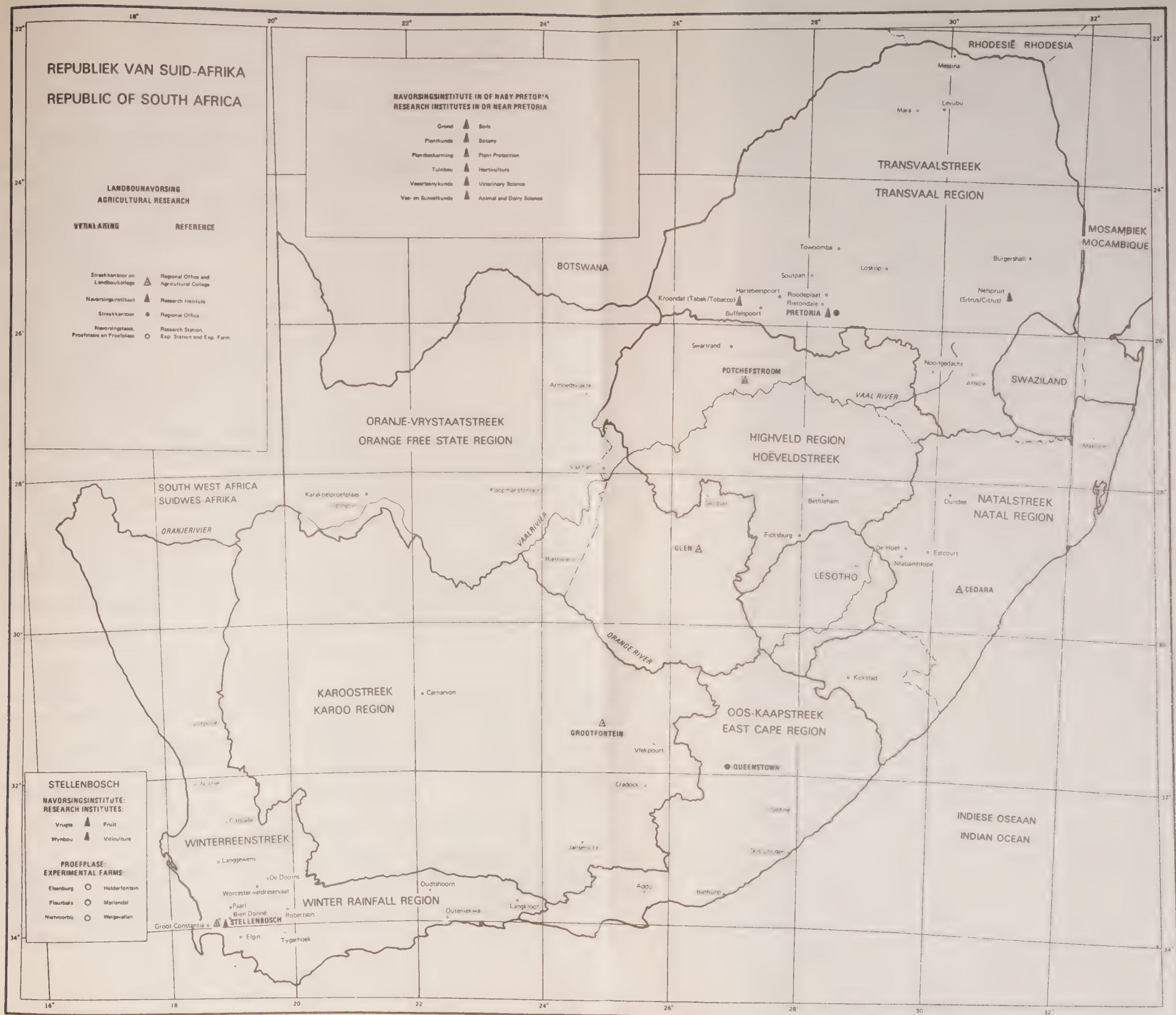
The planning of a new purchasing policy, based on the views of the National Library Advisory Board on the expansion of the national book stocks, was also initiated. Subject areas for purchases for the Central Library will be demarcated so that overlapping of book stocks with those of the regions and institutes will be kept to a minimum.

Collections will be expanded on four levels, namely research, reference, minimum and skeleton. The idea is to expand in particular fields where the greatest concentration of researchers is to be found. The aim is to try to provide the greatest possible coverage, between the Central Library and the branch libraries, of agricultural literature.

Data for the supplement to the agricultural bibliography were collected in collaboration with the branch libraries. The pamphlet series is controlled from the Central Library and the Division of Agricultural Information. The supplement covers the period 1973-78 and contains about 2 000 items.

During the year under review the pamphlets and Government publications were reorganised so that they can be utilised more efficiently.

Building is in progress at several branch libraries. The OFS Region has already moved into its new library and the Karoo and Natal Regions will soon move to new premises. The library at Onderstepoort has been enlarged and the extension has already been occupied.



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VI. Plant Protection Research

BOTANICAL RESEARCH

Progress with botanical research has been good and the rate of publication has been maintained at a high level, usually a reliable indication of the state of the field.

The real awareness of environmental problems and their vital importance to man, which already exists and is growing, will make a large input into biological research, especially plants, unavoidable in the near future.

The control of weeds, particularly in order to protect the pastures, will require careful research planning as well as a stepped-up control campaign, in order to deal with a potentially dangerous situation. In this respect, nassella tussock, Australian acacias and jointed cactus and other members of this family are examples of what can happen if weeds are allowed to get out of hand.

Amongst other activities, the compilation of a national weeds list, which is now complete, is the first step towards monitoring weeds and establishing the status of potentially harmful plants with a view to controlling them before the exponential stage of expansion in the distribution is reached.

The use of electronic devices and computers in research and information services is expanding rapidly. The vast and complicated data bank for herbarium type information is now, after several years of activity, nearing the productive stage.

FLORA RESEARCH

Flora of Southern Africa

Checklists were produced for volumes on mosses and ferns. Vol. 10 Part I, on Loranthaceae and Viscaceae and Vol. 27, Part IV, on *Ceropegia* and related genera van Asclepiadaceae have gone to press.

An introductory volume dealing with botanical literature was published.

Botanical collectors in Southern Africa

The encyclopaedia dealing with plant collectors in alphabetical sequence was completed, except for a few late entries. A historical introduction was written to provide a chronological account of early collecting activities and of literature dealing with Southern African plants, with emphasis on illustrations, up to the time of Linnaeus.

Register of plant taxonomic projects

A new edition of this register listing some 300 current projects on African plants is in the last stages of preparation and will again be distributed throughout the world in form of microfiche cards.

Southern African plants

Material for a brochure on 20 of the most important water weeds in the region was compiled. Two to three colour photographs and a distribution map are provided for each species. The text comprises a brief description, a comparison with related species, a note on distribution and paragraphs on ecology, importance, derivation of the scientific name and literature.

Pretoria-flora

With the completion of a further 298 line drawings only 40 species remain to be illustrated. Special attention was given to the large and difficult families Poaceae and Fabaceae. Apart from minor modifications the drawings for these families are complete and the basic keys and text have been compiled.

Ceropegia and related genera

A fully illustrated account of the genera *Ceropegia, Brachystelma* and *Riocreuxia* is in the final stages of preparation. It will provide information additional to that given in Volume 27,4 of the Flora of Southern Africa and will cater for the world-wide interest in the group by amateurs.

Liaison Officer, Kew

This officer was engaged in a wide range of activities, especially in the fields of weed research, the taxonomy of the Fabaceae and pollination biology. He participated in several symposia and scientific gatherings in the United Kingdom and on the Continent. Numerous herbaria were visited. Problems from different fields of botany were researched for scientists and institutes in South Africa and abroad.

Cytogenetic study of Opuntia aurantiaca

The largest encroachment of *O. aurantiaca* occurred in the Eastern Cape, where it has caused the most problems. In recent cytogenetic studies it was determined that this intruder in South Africa has only one single biotype which was imported from Argentina.

A fossil seed fern, *Dicroidium* sp. from Upper Umkomaas, Natal

In Argentina *O. aurantiaca* formed a complex consisting of hundreds of biotypes. The plant which has infested the Eastern Cape appears to be the vegetative progeny of a single plant or a number of identical plants that were imported to South Africa.

ECONOMIC BOTANY

Conservation of germ plasm

The first stage of a project to conserve germ plasm of primitive crop cultivars and of rare and endangered indigenous species is under way and a survey of over 200 literature references has been completed.

Information service

Two hundred and eighty-three requests for information about economic plants and their utilisation or control were answered by our information service. These included about 440 identifications.

Particular interest was shown in the newly declared noxious weeds: *Sesbania punicea* and *Pereskia* spp., and in the utilisation of indigenous *Euphoriba* spp. and the Mexican rubber bush (or guayule) *Parthenium argentatum*.

A total of 1 638 visitors, including 1 304 scholars and students, were received at the Institute.

Citrullus studies

Material of several new collections of *Citrullus* (one from the Seychelles) was added to our collection. Plantings were made to increase seed of all the entries, as a preliminary to making studies of the origin of the watermelon.

Ethnobotany

Preparation of a report on the ethnobotany of the Tsonga people of Gazankulu has been completed. A survey of the literature referring to the ethnobotany of tribes and peoples in South Africa has also been completed, and will form a base for more detailed research.

Tree distribution in the Transvaal

Two hundred and eighty field listings of woody plants were made. The first objective, a 10 % sampling cover, has been achieved for nearly the whole area, and the ultimate objective, a sampling cover of 25 % has already been achieved in over half the area.

The listings are being used to plot the distributions of all of some 900 species of woody plants that occur in the Transvaal.

Weeds

A first national weed list incorporating the names of over 700 plants has been drawn up. This list is currently being reviewed and added to, and will then be used as a basis for weed status evaluations, i.e. to establish research and control priorities.

A study of *Prosopis* in the northern Cape has shown that, of the three species recorded as having been introduced to South Africa, two are invasive, namely *P. glandulosa* (honey mesquite)) and *P. velutina* (velvet mesquite). *P. pubescens* (screw bean), does not appear to be causing trouble.

A survey was made of encroaching exotic woody species in riparian roadside and veld habitats, in the Pretoria-Witwatersrand-Vereniging area of the Transvaal. Approximately 30 woody species were found to be invasive. Twenty-four species occurred on both the banks of streams and roadsides, but most species showed habitat preferences.

Melia azedarach (syringa), *Acacia dealbata* (silver wattle) and *Acacia mearnsii* (black wattle) are the commonest woody roadside invaders, whereas *Salix babylonica* (weeping willow) and *Populus alba* (white poplar) are the commonest woody stream bank invaders. *Arundo donax* (Spanish reed) is common in both habitats.

The first autecological study of nassella tussock in South Africa is being undertaken at Cape Town by the Botanical Research Institute. The object of the study is to discover ways of modifying and improving control strategies.

GOVERNMENT HERBARIA

Information

A total of 32 432 plant specimens were identified for officers of the Institute, various Government departments and provincial bodies, universities, the public and neighbouring states. The herbaria dealt with 2 534 visitors requiring information on a wide range of subjects.

Development

The collections of the herbaria were increased by 35 101 specimens during the year. Several expeditions were undertaken for this purpose.

The major one, which included two botanists from Germany, lasted for six weeks and was to the little-known Diamond Area No. 1 of SWA-Namibia, between Lüderitz and Oranjemund.

Several visits were made to the area which will be inundated by the new Theewaterkloof Dam near Villiersdorp in order to have a complete record of the plants before they disappear for ever.

Other expeditions were undertaken to the Waterberg, the southern part of the Transvaal Lowveld, Northern Zululand and the Southern Cape and Little Karoo.

Research

Taxonomic research by staff of the herbaria is continuing as a contribution towards the Flora of Southern Africa. The groups covered are Bryales (mosses), where a checklist of all the species has just appeared, Cyperaceae, Ericaceae, Hypoxidaceae, *Pelargonium* and Poaceae.

In the last family a treatment of the 235 grasses with drawings was prepared for the Pretoria Flora. A start has been made on revisions of the families Campanulaceae and Polygonaceae.

BOTANIC GARDENS

At the Pretoria Botanic Garden the development of the collections on an ecological basis has been continued. The savanna biome site was extensively landscaped to improve the habitat for riverine species.

Planting plans for the forest and savanna biomes were finalised and large-scale tree planting took place. A water reticulation for the whole of the northern section was completed during the year. The northern section was maintained as a colourful display area attracting the most attention.

Replanning of parts of the nursery proved necessary to provide a more effective service entrance and better facilities for black staff. Public interest in the garden as a whole has remained keen.

ECOLOGICAL RESEARCH AND SURVEYS

Veld Types of South Africa

At the time of Mr Acocks's death in May 1979 the revision of the veld types of the western half of the country was approaching completion. He had finished writing up all the 25 Karoo and False Karoo types together with the coastal types from the west and south coasts and part of the Kalahari Thornveld. These amount to 32 veld types in all, subdivided into 89 variations. The revision excludes the Mountain Fynbos and the False Fynbos.

Part of the revised treatment of Kalahari Thornveld remains to be completed.

Western Transvaal Bushveld Survey

The final report on this project was written up as a Ph.D. thesis and published in the series *Dissertationes Botanicae* as Band 49 (1979), the title being "Plant Sociology of the Western Transvaal Bushveld, South Africa: A Syntaxonomic and Synecological Study".

Zululand Coastal Dune Survey

The impact of mineral prospecting on dune vegetation in Reserve 10 (Zululand) was uneven, the seaward slope of the dune being the most sensitive area. Regeneration of vegetation on the sampling lines was good.

Wilderness Lakes Study

The macrophyte encroachment problem in the Wilderness Lakes in the Cape Midlands was studied at the request of the Lake Areas Development Board. An increase of macrophytes such as *Potamogeton pectinatus, Phragmites australis* and *Typha latifolia* subsp. *capensis* in some areas was found and mechanical control suggested.

Cape Fynbos Surveys

Vegetation survey of the Cape of Good Hope Nature Reserve

In order to assess the rate of infestation of pest plants (or plant invaders) during the study period, which started in 1966, the re-enumeration of pest plant density was carried out on 29 sample plots during the year.

A primary survey of the Rooiberg Mountain Catchment Reserve near Ladismith, Cape

The completion of the quantitative floristic survey confirmed the expected high degree of correlation between the physiognomic and phytosociological classifications reported on last year.

The results of the reconnaissance survey, including management recommendations, were

A glimpse inside the flower of *Brachystelma chlorozonum* from KwaZulu, showing the large, five-lobed coronal structure

A view of Eilandvlei with Dromedaris Island in the centre, part of the Wilderness Lakes System, where the encroachment by aquatic macrophytes was studied

embodied in a report which was submitted to the Secretary for Forestry, as requested.

Distribution and autecological aspects of the Hakea pest plants, *H. sericea, H. gibbosa* and *H. sauveolens*

Distribution maps for the three South African pest Hakeas have been drawn and analysed and improvements to the present *H. sericea* mechanical control programme have been suggested.

Evidence indicates that all infestations of *H. suaveolens* and *H. gibbosa* can be eradicated in South Africa, except the *H. gibbosa* infestation in the Kleinrivier range and adjoining mountains. A management programme for these mountains has been proposed.

Fynbos biome project

In October the Task Group searched for and found a suitable site to replace the proposed West Coast study site which had been burnt.

A chapter on *The Phytogeography of Fynbos* has been prepared for a volume to be published by the CSIR synthesising present knowledge on the Fynbos biome.

Littoral vegetation of the Southern Cape

To provide quantitative data for a contribution to a book on dry coastal ecosystems (in Elsevier's series *Ecosystems of the World)*, a phytosociological study of littoral vegetation of the Southern and Western Cape is being conducted. During the year floristic data from 163 relevés were collected along the Southern Cape coast from Cape St Francis to Cape Point.

Provisional indications are that the sand-dune flora is remarkably uniform, but there is considerable variation in the flora of the rocky coasts.

Orothamnus project

All the known populations of the marsh rose *Orothamnus zeyheri* in the Kogelberg State Forest were visited during December 1978. Population size and development of selected individuals are monitored annually.

Preliminary results indicate that it takes at least eight years for half the individuals in a population to reach flowering maturity. A total of 1 180 individuals were recorded in the area.

Aquatic ecology

The Braun-Blaquet classification of the "water-plant" communities of Natal, together with a paper entitled: *A preliminary classification of the water-plant communities of Natal*, intended for publication, have been completed. Water-plant communities have been set out in a synoptic table and each described in detail.

The communities follow a broad salinity and pH gradient and have been divided into 6 major groups. These are: (1) marine, (2) estuarine,(3)

brackish water, (4) moderately fresh to slightly brackish water,(5) fresh-water, and (6) communities found in fast-flowing fresh-water.

Field measurements, taken at fortnightly intervals, of growth rates and chemical composition of water hyacinth plants, together with chemical and physical parameters of the water and environment, have been completed. Present synthesis of data has revealed an apparent linear relationship between diffuse radiant flux and the growth rate of water hyacinth plants.

This suggests that light is the primary factor limiting water hyacinth growth, where previously the effect of light was considered to be minimal.

NACOR: National Nature Conservation Plan

The Botanical Research Institute is continuing to co-ordinate the National Nature Conservation Plan for the Department of Environmental Planning and Energy, in co-operation with an officer of that Department.

Approval has been obtained and funds earmarked for the setting up of a data bank for the efficient storage, retrieval and processing of the rapidly accumulating data, using the Department's computer.

DATA PROCESSING

The herbarium data bank reached the final stages of testing, with a view to starting production before the end of 1979.

PUBLICATIONS

During the year Vol. 12,4 of *Bothalia*, comprising 28 articles and 193 pages, appeared in print. Other publications appearing during the year were: *Flowering Plants of Africa* Vol. 45, 3 & 4, *Memoirs of the Botanical Survey of South Africa*, No. 43 (The bryophyta of Southern Africa), an annotated checklist and a *Bibliography of South African Botany* (up to 1951).

In addition, the Institute edited and played a major part in the production of *Plant Invaders - Beautiful, But Dangerous*, published by the Department of Nature and Environmental Conservation of the Cape Provincial Administration.

A total of 101 scientific papers were published by the staff of the Institute during the year under review.

PLANT PROTECTION RESEARCH

NATIONAL COLLECTION OF INSECTS

Specialised taxonomic studies

Parasitic Hymenoptera

The collections of the Encyrtidae and Aphelinidae, the two families that receive the most attention, are still being expanded. Accessions whose hosts and host-plants are known now amount to 5 750. Good progress is being made with the building up of the collection of other families and about 15 000 specimens have already been collected with the aid of collecting nets. The number of accessions for which biological data are known now amounts to 305.

Several parasitic wasps that are associated with pest insects of importance in biological control programmes were identified. During the past year identifications of this kind were undertaken for researchers in the Republic, Mauritius, Réunion, Senegal, the Congo, the Ivory Coast, Israel, Greece, the USA and Australia.

Six taxonomic articles on Encyrtidae and Aphelinidae parasites were published. The articles all deal with species associated with insect pests that are of economic importance.

Bruchidae (Seed beetles)

Problems experienced with the identification of Bruchidae seed beetles were solved by Dr J. Decelle of the Koninklijk Museum voor Midden-Afrika, Tervuren, Belgium. Dr Decelle confirmed the identification of about 40 insects of 26 species or named the insects in cases where identifications could not be made.

Xylocopidae (Carpenter bees)

During the year approximately 3 200 new accessions representing twenty-two families of Hymenoptera were collected, mounted, labelled and curated into the National Collection of Insects. This figure does not include Xylocopidae.

Approximately 620 new accessions, representing eleven of the fourteen Ethiopian subgenera, were collected during the year under review. The new accessions have been mounted, and labelled and are being used in a taxonomic revision of the group.

Most of the literature on the species of the Xylocopidae that occur in Southern Africa has now been collected. A taxonomic catalogue of all the species and all the literature, to date, of the Afrotropical region has been completed.

The collection of nests in the field, in order to extend information on the mortality, nesting woods and biology of natural carpenter bee populations, is also continuing.

Isoptera (Termites)

The distribution in Southern Africa of the cosmotropical dry-wood pest *Cryptotermes* was reviewed and the text accepted for publication. Work was continued on the systematic revision of the humus feeder *Lepidotermes*.

Routine determinations of Isoptera, including samples submitted by the public, amounted to 320 series. The annual increment to the collection was 193 series produced by the National Survey of Isoptera, plus 22 series donated from foreign countries and including five species new to the collection. The total of termite samples in the

National Collection of Insects (NCI) stood at 33 407 at 30 June 1979.

Field survey trips consisted of intensive collecting in selected areas, with emphasis on the termite imago caste and the termitophilous arthropods. *Macrotermes* and *Odontotermes* nests were searched in the Bronkhorstspruit district of Transvaal; *Rhadinotermes,* a rarer taxon, was collected in the Nongoma, Ngotshe and Ubombo districts of Natal; *Microbodotermes* was investigated in the Beaufort West district of the Cape Province. New data were obtained on the occurrence of winged termites and an aggregate of 4 250 specimens in 195 series of termitophiles was collected from 65 nests of 4 termite host species. As before, Coleoptera were the most abundant (2 385 specimens), followed by Diptera (1 654 specimens belonging to the Phoridae family).

Neuroptera (lacewings)

The collection of Myrmeleontidae and Nemopteridae, comprising over 2 700 pinned and labelled specimens, was moved from Grahamstown to the National Collection of Insects in Pretoria during February, 1979. This collection forms the basis for the study on the biology and systematics of the Southern African species and is steadily being augmented.

In addition to the Myrmeleontidae (ant-lions) and Nemopteridae (thread lacewings), collections of the other families in the Neuroptera are being established. Many of these families (e.g. Hemerobiidae (brown lacewings) and Chrysopidae (green lacewings)) are of economic importance as predators of pest species, so a comprehensive reference collection of these insects will be of great value. Over 200 specimens belong to the families Hemerobiidae, Chrysopidae, Coniopterygidae, Mantispidae and Osmylidae were collected and curated in recent months.

Tephritidae (Fruit flies)

The pre-final write-up of some sections of the investigation was completed. Sundry non-African species required study to check statements made by authors in the area, in order to stabilise the status of the key species of the subfamily, *Dacus armatus* Fabricius.

A small collection of Dacinae from the Paris Museum consisted almost entirely of common species that were easily identified. It was a useful exercise in checking the present system of classification.

Coccoidea (Scale insects)

The revision of the cottony scales of South Africa was completed. Altogether fifteen species and three genera were dealt with. In the old genus *Pulvinaria* Targioni Tozzetti eight species were retained: *aethiopica* (De Lotto); *claviseta* De Lotto; *grabhami* Cockerell; *iceryi* (Signoret); *merwei* Joubert; *mkuzei* Hodgson; *psidii* Maskell and *saccharia* De Lotto. To them were added and described two new ones and one old which was originally assigned to the genus *Coccus* Linnaeus.

Besides the type *P. mesembryanthemi* (Vallot), a *Mesembryanthemum* species was assigned to the genus *Pulvinariella* Borchsenius. For another new species, also from *Mesembryanthemum* sp., a new genus was named.

A revision of the material accumulated in the course of the past few years brought to light three new species. One species was referable to the genus *Ceronema* Maskell and one to *Platysaissetia* Cockerell; for the third species a new genus will have to be named.

The card index of the plants attacked by soft scales which are incorporated in the National Collection was brought up to date.

Routine identifications and advice were supplied to institutions and researchers in South Africa as well as in Bolivia, Greece, Holland, Israel and Uruguay.

Pseudococcoidae (Mealybugs)

A thorough study of some material accumulated during past years brought to light twelve new species of mealybugs referable to the genera: *Albertinia* De Lotto (one); *Annulococcus* James (one); *Coccidohystrix* Lindinger (two); *Distichlicoccus* Ferris (one); *Misericoccus* Ferris (one); *Erium* Cockerell (two); *Oxyacanthus* De Lotto (two); *Paraputo* Laing (one) and *Rhizoecus* Künckel (one). To them should be added four more species for each of which a new genus will have to be introduced.

The card index of the plants attacked by mealybugs which are incorporated in the National Collection was brought up to date. The checking of the card index of world mealybugs was started and numerous old and new species and references were recorded.

Routine identifications and advice were supplied to institutions and researchers in South Africa as well as in Bolivia, Greece, Holland, Israel and Uruguay.

GENERAL COLLECTION OF INSECTS

The qualitative survey of the insects of the Nylsvley Nature Reserve, which was started in 1978, was continued. This project forms part of an ecological study of the Reserve, undertaken under the aegis of the CSIR. So far 5 500 specimens have been collected, pinned up and labelled; these specimens may represent over 1 000 species. Collecting has stopped temporarily and the identification of the material has started.

Four collecting trips were undertaken during the past year: one to the Eastern Cape, one to the Soutpansberg area of the Northern Transvaal and two to Barberton. A survey of the insect fauna of a new nature reserve opened near Barberton by the Transvaal Provincial Administration was carried out. Some of the specimens collected will form part of a permanent exhibition at the new Provincial

Museum now being developed at Barberton. In the course of the collecting trips about 6 000 specimens were collected, 4 830 of which have been mounted, pinned up and labelled. The specimens represent 10 insect orders (80 families). Several hundred other accessions were also obtained when insect material was submitted for identification.

The change-over to the use of unit cases for preserving specimens has been completed. In all 3 200 drawers have been equipped with these cases, which makes the arrangement of specimens and the general work done in the collection considerably faster and easier. All alcohol material is now preserved in four freezers. As a result this collection now requires virtually no care, evaporation of the alcohol being kept to a minimum.

The identification service of the General Collection is continuing to function very well and the demand for identifications has increased considerably. During the past year 109 jobs, which included 1 100 identifications, were completed.

During the year under review the National Collection continued to fulfil an important function with regard to liaison with the public. Enquiries on insects and their control are answered virtually daily.

CHEMICAL CONTROL OF INSECTS

Pesticide dynamics

The investigation into the incidence of pesticide residues in meat and meat products was continued. Specimens were taken in Cape Town, Durban, Port Elizabeth, Pretoria and the Transvaal rural areas. The results of analyses of these specimens show that dieldrin still occurs in over half the specimens at concentrations in excess of the maximum permissible residues. These results emphasise the necessity for strict control over the use of dieldrin in South Africa.

The incidence of pesticide residues in vegetables was also investigated. Solvents suitable for use in the analyses were tested and it was found that, for cost and efficacy, a mixture of hexane and acetone is the best solvent. The use of a hexane-acetone mixture as a solvent simplifies the cleaning of the specimen extract. Both this task and other analytical methods were investigated on the instructions of the Task Group for Pesticide Residues in Foodstuffs, which falls under the Working Group for Pesticide Residues of the National Programme for Environmental Sciences.

A series of specimens taken from birds and fish were analysed in co-operation with the Division of Nature Conservation of the Transvaal Provincial Administration. These analyses were carried out on behalf of the Subcommittee for Wildlife Mortality, which is also part of the Working Group for Pesticide Residues. Organochlorine pesticides such as BHCS, DDT, dieldrin and endosulfan were found to occur generally, in high concentrations. It is nevertheless clear from the results that animals that had died in the veld and the animals sampled had the same residual concentration in their bodies. Therefore, no direct relationship between mortality and pesticide concentrations could be shown.

An investigation of the formulations of pesticides as wettable powders showed that it is not only the concentration of the active ingredient in the formulation which is of importance. Properties such as suspendibility, resuspendibility, foaming, particle size and wetting all play an important part during the application of the pesticide on the farm. Trials are being carried out at present in which commercial pesticides are being tested and compared for these properties, the aim being to keep inferior formulations off the market.

A trial was started in which the residual action of the triazine weedkillers such as atrazine was determined in soil. It was observed that the planting of susceptible crops such as sunflowers after an application of atrazine the previous season can lead to complete crop failure. This residual action appears to be related to the soil type and it is intended to identify affected soil types and try to determine how the residual period can be reduced.

Trials have shown that captab, a fungicide used as a seed treatment for maize, can be removed by means of a simple washing process. This process has advantages for several agricultural organisations that have large quantities of surplus seed maize on hand. After captab has been removed the maize can be used as stock feed.

A trial was launched during the year to determine what effect a light shower of rain has on the control of an insect pest shortly after a pesticide has been sprayed. The precipitation of the pesticide was determined before and after light artificial rainfall. Three pesticides were tested, namely endosulfan, carbaryl and parathion and the spraying was carried out on cotton. It was found that up to 5 mm of rainfall within the first four hours after spraying does not reduce the precipitate of certain pesticides very much. Over 5 mm of rainfall, and especially precipitations of 7 mm and more, washed this pesticide off almost entirely.

A number of analyses were carried out for other regions and institutes, e.g. aldicarb was determined in chrysanthemum leaves for the Tobacco Research Institute, pirimicarb in pecan nuts for the Citrus and Subtropical Fruit Research Institute and several pesticides in potatoes for the Transvaal Region.

Insect pests of cotton

Six candidate pesticides were subjected to exposure trials and two, namely SAN6538 (organophosphatic) and A5998B (synthetic pyrethroid) were found to be promising for the control of American bollworm larvae.

The ovicidal action of the synthetic pyrethroid pesticides that are now in general use for the control of the bollworm complex in cotton, namely cypermethrin, fenvalerate, decamethrin and permethrin, was investigated. No ovicidal effect was found in American bollworm sprayed with the recommended field dose of the various preparations. Embryo development was normal during the pre-hatching period. However, high

mortalities inside the eggs were obtained during the hatching process, when the larvae start eating through the shell. The mortalities are ascribed mainly to the contact and oral action of the pesticides.

Development work on the synthetic pyrethroids (cypermethrin, decamethrin, fenvalerate and permethrin) was geared in the past mainly to finding doses at which the pesticides could be applied for the control of the bollworm complex in cotton at 14-day interspraying intervals.

The higher doses applied to obtain this residual action had an adverse effect on the egg parasite population of the American bollworm, however.

During the past season the emphasis shifted to lower doses applied at shorter intervals. The present doses were reduced to 40 % of the original recommendations and applied at seven-day intervals. Results showed that good control of the bollworm complex in cotton was still obtained at lower doses.

Owing to the harmful effect of synthetic pyrethroid pesticides on the ecological balance of nature, the Department has drawn up a uniform control programme, in co-operation with interested persons who were responsible for the development of these pesticides. The programme makes provision for the inclusion of the synthetic pyrethroids in an integrated control programme for cotton. In future synthetic pyrethroids for the control of bollworm will be recommended for a limited period only during the growing season of the cotton.

In the Rust der Winter and Groblersdal areas, where weather conditions were ideal for the development of red spider mite infestations on cotton during the season, it was found that these synthetic pyrethroids do not control, suppress or stimulate red spider mite.

BIOLOGICAL AND INTEGRATED CONTROL

Stalk borers and American bollworm

The study of the possibility of controlling American bollworm and stalk borers of grain crops by biological means resulted in the development of techniques for breeding natural enemies of the insect pests, the pests themselves and alternative hosts for the parasites on a large scale in the laboratory. This makes both the large-scale release of natural enemies and other biological studies possible. Several egg parasites of the American bollworm have already been bred and recently two new parasites, namely *Trichogramma braziliensis* and *T. achaea,* were received from France for testing against Lepidoptera pests in South Africa.

In all 246 000 *Trichogramma pretiosum* 68 000 *Trichogrammatoidea armigerae* parasites of the American bollworm were released at Groblersdal, Greytown and Roodeplaat during the past season. Surveys to determine to what extent the parasites became established are still in progress. Trials showed that spraying resulted in a general reduction in the parasite population, although it would appear that there is no difference between the parasite population in the sprayed and unsprayed plots.

It appears that although chemical control is often unavoidable, in some instances spraying may be unnecessary or uneconomic.

Karoo caterpillar

During the past season fairly severe outbreaks of the Karoo caterpillar occurred in those parts of the Richmond district where it rained in late summer and autumn. Elsewhere conditions were mostly dry and only isolated patches of larvae were noted.

The large populations recorded in the Western Karoo during the past few seasons did not lead to the expected severe outbreaks, since drought conditions have prevailed there since early 1978.

Termites

The drought resulted in an abundance of dry grass, especially in the central and western parts, with a consequent increase in the incidence of harvester termites, and this is causing farmers some concern. Large-scale spraying was discouraged on the grounds that the expense was not justified in extensive stock farming. At most a spot-treatment with bait was recommended, and then only in exceptionally heavily infested camps.

Potato tuber moth

A programme for integrated control of potato tuber moth proved successful when tested on three farms in the Southern Transvaal.

The imported parasitoids *Apanteles subandinus* and *Copidosoma koehleri* have both been recovered from the Fish River Valley and this augurs well for the biological control of the tuber moth in this area.

Plant mites

Studies on the biological control of spider mites *Tetranychus* spp. in glasshouse crops were continued. Experimental releases of the predacious mite *Phytoseiulus persimilis* were made on commercially grown crops of chrysanthemum and English cucumber. It was noted that the release of *P. persimilis* on infested chrysanthemums, when the plants are 5 weeks old, allows sufficient time for the mites to be controlled before the flower buds open.

BIOLOGICAL CONTROL OF WEEDS

Hakea

A further 350 *Erytenna consputa* weevils were released at seven new sites in the Southern Cape on *Hakea sericea.* Another 400 *Erytenna* weevils collected on *Hakea gibbosa* around Sydney were

released at eight new sites on the Onrus, Kleinriviers and Perdeberg Mountains and at an isolated stand near Elim. A total of 20 releases have now been made on infestations of *H. gibbosa,* which is a serious threat.

Populations of the weevil on *H. sericea* are still increasing satisfactorily and the destruction of young fruits at many sites is very encouraging. Attempts to measure the effect of the weevil on the production of fruit by *H. sericea* are to start later in the year.

The laboratory culture of *Carposina autologa,* whose larvae attack mature *H. sericea* fruits, produced 350 moths this year (February-June 1979). A total of 3 500 eggs were produced by these adults and 1 600 larvae emerging from these eggs will be used to continue the culture. In addition a further 2 400 eggs from the Mittagong area in Australia were received, and 500 larvae produced from these eggs were used to boost the laboratory culture.

Further trials to improve the technique of inserting larvae in fruits in the field are in progress. The method used last year (1977/1978) yielded poor results with only 8 % of the larvae inserted in fruits reaching the adult stage. An improved drilling technique using an electric drill is being used.

To date 400 larvae from eggs received from Australia have been inserted in fruits. 30 male and 30 female moths were released in a 3x2x2 m tent to study this method as a practical method of establishing *C. autologa* in the field. This method could also be used to set up field cultures of *C. autologa* to replace the laboratory culture.

Specificity trials with the leaf-tunnelling weevil *Cydmaea binotata* have nearly been completed. So far 70 plant species have been tested, the majority being indigenous Proteaceae. *C. binotata* is able to reproduce on some other *Hakea* species with needle-like leaves (e.g. *H. gibbosa*) and the adults do feed on some *Grevillea* species. Indications at this stage, however, are that its potential hosts are limited to the tribe Grevilloidea of the family Proteaceae. None of the South African Proteaceae belongs to this tribe.

St. John's wort *(Hypericum perforatum)*

A laboratory culture of the aphid *Aphis chloris* was finally established using material received from Canada. This aphid has been thoroughly tested for specificity overseas. Further testing with indigenous members of the family Clusiaceae will be carried out before a decision to release the aphid is taken.

Further attempts at establishing the midge *Zeuxidiplosis girardi* on *H. perforatum* near Tulbagh failed. Substantial defoliation, together with high numbers of *Chrysolina gemellata* larvae, was, however, observed there during June.

Jointed cactus

Between June and August 1978 several new insect enemies were collected in South America and sent to South Africa for the biological control of jointed cactus. Of these only the moth *Mimorista pulchellalis* survived. It is being kept in quarantine, where it breeds freely on jointed cactus at Uitenhage and Grahamstown while undergoing host specificity tests. The insect appears to be host-specific on jointed cactus.

Jointed cactus and cochineal *Dactylopius austrinus* population studies indicated that a surprisingly high percentage of small plants and loose joints desiccate during the dry summer months while cochineal continues to be the only effective enemy of all the plant category sizes. Unfortunately its efficiency is not consistent and varies considerably in the various regions of the Eastern Cape.

Releases of *Tucumania tapiacola* on jointed cactus continued and 500 000 eggs have already been released, but in spite of these efforts there has not been any significant build-up of populations in the field.

Egg predators are not the only factors hindering establishment. The size and situation of each host plant is also critical to the colonising young larvae. They need young etiolated plants growing in shade as opposed to plants growing under dry, exposed and sunny conditions. Consequently only adult moths will now be released, assuming that the female moth will oviposit on the plants most favourable to egg and larval development.

Prickly pear

Prickly pear is now regarded as a beneficial plant by approximately half the landowners in the Eastern Cape and Karoo who have the weed on their properties. This change in attitude rules out any renewed biological control efforts. A survey also showed that infestations are probably increasing and that the application of chemical control has declined steadily since 1967.

Cactoblastis cactorum is the key enemy of prickly pear regrowth and it still does a great deal to prevent regrowth from becoming established. Between 4,5 % and 23,8 % of all regrowth plants up to the 10 cladode stage are killed annually by this insect. The performances of *Dactylopius opuntiae* in suppressing regrowth is poor, ranging from 0 % to 7,4 %.

Metamasius spinolae continues to spread slowly. The original prickly pear infestations at Springfontein near Uitenhage have practically disappeared because of the continued onslaught of this insect and only a few heavily infested plants remain.

Lantana camara

A large consignment of the leaf-mining beetles *Uroplata girardi* and *Octotoma scabripennis* was received from Australia and the beetles were released in suitable localities in Natal and the Northern Transvaal. A sucking insect, *Leptobyrsa decora,* was bred in large numbers and released throughout the summer. At the Natal South Coast

(at Margate) it was possible to demonstrate by means of growth studies that *Teleonemia scrupulosa* and the two leaf-mining beetles mentioned above do have an inhibiting effect on the growth and reproduction of *Lantana*. On a long-term basis these insects could be valuable in the biological control of *Lantana camara*.

Acacia **spp.**

Trichilogaster acaciae-longifoliae (Frogg.) (Hymenoptera: Pteromalidae) is a gall-forming insect of the flower axils of *Acacia longifolia* Willd. in Australia. It was demonstrated that galls also developed in branch axils, leaves and in the growing points of branches of *A. longifolia*. Only one generation occurs in most of the population, but a small section produces two generations. Specificity trials showed that the galls develop only on *A. longifolia* and not on any of the other seven South African or four Australian *Acacia* spp. on which they were tested.

Three species of the seed-eating *Melanterius* spp. were imported from Australia, but the adults could not be kept alive long enough for specificity trials.

Imbricate cactus

Dactylopius tomentosus is doing exceptionally well on imbricate cactus infestations near Steytlerville and Oudtshoorn. No other methods of control will be necessary to control the weed in these areas. This insect has also been released on newly discovered infestations near Upington.

INSECTS IN STORED PRODUCTS

Fenitrothion, a preparation which produced promising results a few years ago with regard to the protection of fumigated bag stacks of grain and oilseeds, was sprayed on all the stacks in one shed at Vredefort this year in a further trial. This preparation does not have good ovicidal properties and is therefore unable to prevent larvae, especially of the tropical warehouse moth and the Indian meal moth, from penetrating the grain and doing damage when the population pressure is high. However, it has now been demonstrated that where an entire depot or shed has been sprayed with the preparation the population pressure falls over a period and the preparation performs considerably better.

Metacriphos is a new preparation which was tested on bulk maize in the laboratory this year. In general it provided good protection against insects. It was least effective against the lesser grain borer and the confused flour beetle, which were controlled for 33 and 37 weeks, respectively, at 7 mg/kg, whereas other insect species are controlled for over a year at this dose. No taints occurred as a result of this treatment.

Rust red flour beetles from 61 localities in the Republic were tested for resistance to mercaptothion and lindane during the past year. Resistance to these two preparations is common and the degree of resistance is high. Insects with the ordinary organophosphate type of resistance to mercaptothion were also tested for cross resistance to potential soil protectants. The insects proved to have a high cross resistance to bromophos, a fair to slight resistance to tetrachlorvinphos, a slight resistance to diazinon, a very slight resistance to pirimiphos-methyl and fenitrothion and no cross resistance to dichlorvos and metacriphos. Cross resistance to phoxim and chlorpyrifosmethyl has yet to be tested.

BEE RESEARCH

Long-term studies on crop plants, eucalypts and indigenous plants as suppliers of nectar and pollen continued. Vandalism among experimental hives at different localities seriously affected research results. The identification and counting of pollen pellets from traps revealed that minor beeplants, e.g. grasses, are important for maintaining colony strength. Preliminary investigations were made into the movements of marked drones between apiary and congregation areas, mainly to consolidate information gathered previously and to formulate experimental techniques to be followed in future research on drones.

During the year negotiations for the acquisition and fencing of a 25 ha area at Roodeplaat, north of Pretoria, were finalised. Test plantings of eucalypts will be carried out there. Between 30 and 40 *Eucalyptus* spp. will be assayed for their suitability as beeplants in this summer rainfall locality.

Several consignments of live and frozen bees of both African and Cape species were despatched to bee laboratories in Europe and the USA for research on behaviour and biochemical composition.

As in the past, there was a steady stream of visitors to the bee laboratory. They included queen breeders and beekeepers from Germany, France, Belgium, Holland and England.

The Afrikaans edition of the bulletin on bees, No. 394, was published during 1978. In the mean time the revision of this popular book was started. The 2nd impression of the English edition has already been sold out.

SATOUR was assisted in the production of a brochure for groups of overseas beekeepers that wish to visit South Africa.

The breeding programme has now reached the stage where selected crosses and their reciprocals are being tested for the first time under controlled conditions at Robben Island.

The field testing of the selected queen lines under commercial conditions is continuing. The purpose of the programme is selection for honey production and swarm resistance. Field testing techniques are always being modified, and at present ways of overcoming "progressive robbing" are being investigated.

The pollination work in apples is proceeding. Judging by the increasing interest shown by plum, pear and apple growers, as reflected by inquiries received, the importance of pollination and the

activities of honey-bees in orchards is receiving increasing recognition. In lucerne pollination work, at least from the preliminary observations, it appears that honey-bees are the most important and reliable pollinators. During the observation periods this year no xylocopids (carpenter bees) were observed, although they were surprisingly numerous during the previous year.

The monitoring of the honey-bee populations in various reserves belonging to the Cape Provincial Administration and the Cape Divisional Council shows that they are increasing. This means that these areas are successfully serving as sanctuaries for the preservation of the unique Cape honey-bee.

POLLINATION OF LUCERNE

A sampling program was worked out for estimating the number of lucerne flowers and the seed yield produced in the 1978/79 season on the experimental lucerne field at the Oudtshoorn Experimental Farm. The behaviour of the carpenter bee *Xylocopa caffra* was also studied in order to estimate its possible effect on lucerne pollination.

The most important solitary bee pollinating lucerne in November 1978 on the Oudtshoorn Experimental Farm was *Xylocopa caffra*. About 26 females of this species nested in the shed beside the experimental lucerne field in the 1978/79 season. While these *X. caffra* females were working very actively on the lucerne in November, the smaller *X. caffrariae* was inactive, and there was no sign of leaf-cutter bees *Megachile* sp.

When the Oudtshoorn Experimental Farm was again visited in February 1979, *X. caffra* was inactive and *X. caffrariae* was working very actively on the lucerne instead. Also about 20 leaf-cutter bees had colonised the cut reeds in the shed and were very actively engaged in collecting lucerne pollen. These two *Xylocopa* species and *Megachile* could form a complementary series of lucerne pollinators effective from spring to late summer.

Because it is large and heavy, *X. caffra* trips virtually every flower it visits, whether it is collecting pollen or not, and it also works much faster than the honey-bee. *X. caffrariae* is rather less efficient than *X. caffra* and some *X. caffrariae* females were seen penetrating the lucerne flowers from the side to obtain nectar without tripping them. The leaf-cutter bees seen working on the lucerne were all collecting pollen and tripped virtually every flower they visited.

FOREST AND TIMBER INSECTS

Defoliators

During October 1978 aerial spraying was carried out against the pine emperor moth *Nudaurelia cytherea* in the La Motte and Lebanon State forests of the Western Cape. *Tolna limula*, a new forest pest of pines *P. radiata*, which appeared in the Southern Cape during 1977, has returned to an endemic level.

Two aerial spraying trials for the control of defoliators of Transvaal pine plantations were carried out. At the Klipbankspruit plantation good control of the pine emperor moth *Nudaurelia cytherea clarki* was obtained with endosulfan and cypermethrin. An extensive outbreak of pine brown tail moth *Euproctis terminalis* occurred in *Pinus patula* compartments at the Nelshoogte and Jessievale State forests. At Nelshoogte a total of about 90 h was defoliated. Because there are no preparations for use against this insect at present, a preliminary spraying trial was carried out in which three insecticides were evaluated for their efficacay against *Euproctis*. The preparations were endosulfan, cypermethrin and *Bacillus thuringiensis*.

The European bark beetle *Orthotomicus erosus* now occurs in the forestry areas of the Western, Southern and Eastern Cape. It would appear that the insect functions as a primary pest of pines during abnormal weather conditions such as drought. Normally, however, the insect seems to be of secondary importance, as in its original home. The insect has been observed on *P. elliottii* as well. Because of widespread alarm about the possible importance of this group of beetles in the forestry industry, field surveys were carried out in the most important forestry areas of the Eastern and Northern Transvaal during January and February 1979. No signs of the European bark beetle have so far been observed in these areas.

The black pine aphid

The black pine aphid *Cinara cronartii* was again very active in pine plantations throughout the country. A population survey using Moericke traps over an area that included the Northern, Eastern and Southern Transvaal, Natal, Zululand, Transkei and the Eastern Cape showed that aphid numbers in all these areas followed the same seasonal pattern. During summer the black pine aphid appears to be absent from pine plantations; from March onward numbers start increasing and a peak is reached during August and September, after which numbers drop rapidly again. At present there are strong indications that climatic factors, especially rising temperatures, are the reason for the drop in pine aphid numbers after the winter. The riddle of where the aphids spend the summer was solved during the year. It was found that the aphids live in pine roots during summer, probably to escape the high ambient temperatures. The subterranean aphids found in the Eastern Cape, Eastern Transvaal and Natal are furiously attacted by cocktail ants *Crematogaster peringueyi* Em.

High *C. cronartii* numbers, particularly in the Northern and Eastern Transvaal, continued to be a cause for concern among foresters.

A number of young pines died in the New Agatha State forest after severe aphid attacks. However, these trees were also infected with pathogenic fungi.

Trials to determine the effect of pine aphid infestations on the growth of pines are in progress in the Eastern Transvaal and Natal. Similar trials will be laid out in other regions.

The pine woolly aphid

Work on the pine woolly aphid *Pineus laevis* (Maskell) continued. This aphid attacks mainly the Mediterranean pine species in the Transvaal. At the present the insect occurs in an area bounded by Warmbaths in the north, Vereeniging in the south, Bronkhorstspruit in the east and Rustenburg in the west. It has not been observed in the official forestry areas so far.

Several spraying trials were carried out to find a suitable control measure for use against the woolly aphid. Cover spraying with lime sulphur at a dose of 8 mℓ per litre, repeated twice in the course of 10 days, produced the best results. The pine woolly aphid is vigorously attacked by a tortoise beetle *Exochomus* sp. and spraying with organophosphatic and chlorinated hydrocarbon insecticides is not only ineffective against the woolly aphid but also eradicates the natural enemies, with the result that such spraying encourages rather than eradicates the aphid.

Timber insects

Overseas techniques for breeding timber insects are being successfully applied and about 5 000 single cultures of *Hylotrupes bajulus* are bred annually. Researchers are concentrating on this insect at present and the programme includes work on determining the most suitable culture medium.

A gift of marula wood by the Department of Forestry has made the breeding of *Lyctus brunneus* considerably easier and there should shortly be sufficient material of this insect available for laboratory testing purposes.

Breeding colonies of *Cryptotermes brevis, Anobium punctatum* and *Heterobostrychus brunneus* are progressing well.

General

During June 1979 a refresher course on pests of the forest and timber industry in South Africa was presented by the University of Stellenbosch in co-operation with the staff of the Institute. Over 700 participants from all parts of the country, and from Lesotho and Swaziland, attended the course.

ANIMAL PESTS

National Collection of Nematodes

The collection of nematodes was expanded to 15 163 microscopic slides, representing about 62 000 specimens. Three long collecting trips and two short ones were undertaken and many nematodes were acquired.

Taxonomic studies included a study of the genus *Xiphinema* which produced three new species. Additional material of the genera *Rotylenchus, Criconemella, Macroposthonia* and *Discocriconemella* was studied and two new species were described from this material.

Virus transmission by nematodes

Populations of five *Xiphenema* species, including *X. index,* from vineyards have been established and are being maintained under glasshouse conditions. Preliminary indications are that *X. index* can transmit GFV under local conditions.

Nematode vectors of viruses in vines

An investigation into the use of DD soil fumigant against *X. index* was continued. Figures indicated that, after a shallow placement of the nematocide, nematode populations recovered completely within two years, but after a split shallow/deep treatment numbers remained somewhat depressed.

Meloidogyne (Rootknot nematode)

Populations of *Meloidogyne* species from 30 localities in the Republic are being maintained in the glasshouse. Attempts are being made to identify the species and possible races with the aid of various techniques.

The genus *Variasquamata* was found in South Africa for the first time. The spiral nematode study for the Government of Fiji was completed and ten species of the genus *Heliocotylenchus* and one each of the genera *Scutellonema* and *Hoplolaimus* were found. An identification key for the *Helicotylenchus* species was also compiled.

During the year under review 1 725 routine seed, soil and root samples were processed. Of this number 975 came from the Division of Plant and Seed Control and the rest from farmers, private bodies and other Departmental bodies.

Nematodes in maize

According to preliminary surveys in various localities in the maize production areas, lesion nematodes (internal parasites) and stubby root nematodes (external parasites) were generally present, sometimes in large numbers, and rootknot nematodes and ring nematodes were found in small numbers in a few cases. Rotational cropping with maize and sunflowers and grain sorghum appears to have no significant effect on the size of the nematode populations.

Potato cyst nematode

In the Bon Accord irrigation area potato lands are still infested with small populations of this nematode in 2 out of 15 small holdings, and on the East and West Rand the figure is 8 out of 18 small holdings.

National collection of Arachnida

Mite accessions numbered 2 235 and spider accessions 350.

A new mite pest *Aceria tulipae* was discovered on garlic. It is the vector of two mosaic viruses found in wheat and maize. Furthermore, the plants become malformed and dwarfed as a result of

feeding by the mites. It was determined in the course of a survey that this species occurs on garlic at Brits, Onderstepoort, Louis Trichardt, Laersdrif, Windsorton and Victoria West. It has not yet been found on wheat and maize in South Africa, however.

Cotton mites

The efficacy of a number of candidate acaricides was determined against adult *Tetranychus cinnabarinus* females, as well as eggs, under laboratory conditions. Two preparations that did fairly well were included in a field trial at the Loskop Research Station for further evaluation, but did not come up to expectations under field conditions.

Nine acaricides underwent small-scale field trials during the season. Spraying was carried out with the aid of knapsack sprays. According to population surveys before and after the spraying, six of the preparations compared well with the standard acaricide.

The monitoring of mite populations is necessary for the effective control of red spider mite on cotton. Early control, before the populations exceed two adult females per leaf, is recommended. An increased spray volume of 45 to 50 ℓ per ha during the season provided better control of established populations than the usual 30 ℓ per ha. This volume will in future be generally recommended for the control of red spider mite.

In order to determine the possible resistance of red spider mites to triazophos, an organophosphatic acaricide, in the Groblersdal cotton area, mites were collected from the farms Klipbank and Krokodildrif, where resistance to organophosphates is supposed to occur. The population's LD50 and LD90 mortality values were compared with those of a standard laboratory culture considered to have no resistance. Probit analyses showed no LD differences in the two cultures, and it may be accepted that at present there is no tendency to resistance against triazophos, which is generally used in the area. In order to avoid a possible build-up of resistance, a rotational spraying programme is recommended for all the cotton areas.

Rodents

The testing of rodenticides against the gerbille *Tatera brantsii* was continued and good results were obtained with several preparations. No complaints of serious gerbille outbreaks on the Highveld were brought to the attention of the Department during the year under review.

PLANT PATHOLOGY

Mycology

Fungus identifications

The demand for identifications of fungal specimens from workers in other Departments or Institutes continued at a steady pace throughout the year. Well over 3 000 specimens (mostly plant pathogens) were identified, and many of the less common ones were recorded and deposited in the mycological herbarium. Among the important or more interesting fungi found during this year were:

Sclerotinia sclerotiorum on sugar bean near Komatipoort and *Sclerospora sorghi* on maize in the same area in the autumn of 1979; *Cylindrocarpon destructivum* and *C. wilkommii,* which are associated with root-rot of various fruit trees and ornamentals; *Bothiorella* spp. on various *Proteaceae* spp. in the South-Western Cape Province and Transvaal; *Puccinia polysora* on maize near Durban; *Alternaria macrospora* on cotton near Groblersdal; *Verticillium dahliae* on sunflowers near Delmas; *Coniothyrium atriplicinum* on seed of *Atriplex semibaccata; Phyllosticta citrullina* on pumpkins from the Nylstroom district and *Periconia manihoticola* from leafspot of *Manihot esculenta* from Burgershall.

Taxonomy and mycoflora survey

A start has been made with a study of the genus *Helminthosporium,* in the wide sense, in South Africa. Preliminary results indicate that 31 species, nearly twice the number of species recorded in the last account of this genus, which was published in South Africa in 1954, are now known to be present.

The survey of the pathogenic fungi of lucerne included lucerne-producing areas of the South-Western Cape and the Little Karoo, the Lower Orange River and Vaalharts. The fungi causing leafspot diseases in other areas were also found in these areas. Two species of *Colletotrichum* were found to cause anthracnose symptoms on the stems. *Fusarium* species, especially *F. solani* and *F. oxysporum,* were most frequently associated with root-rot symptoms and *Phytophthora* spp. and *Pythium* spp. were found in soils of lucerne fields in most of the areas surveyed.

In a survey of the mycoflora of a Karoo pasture at the Grootfontein College of Agriculture more than 50 genera were identified, some of which occurred in small numbers only. No species known to be toxic to grazing animals, other than *Pithomyces chartarum,* was found to be present on this material.

Toxigenic fungi in stock feeds

In the research on the occurrence of toxin-producing fungi and mycotoxins in stock feeds, *Fusarium moniliforme* was found to be the most common species with toxigenic potential in these samples. Other toxigenic species found include *Aspergillus flavus, Aspergillus clavatus, Myrothecium* spp. and *Trichothecium roseum.*

In a survey in which the occurrence of *Pithomyces chartarum* on plant litter and pasture plants was monitored in pastures at the Grootfontein College of Agriculture, this fungus was found on the litter and on *Tribulus terrestris* in small numbers at the beginning of summer. Numbers gradually increased until the end of April.

This was the only species found which is known to cause photosensitivity in grazing animals.

During two field outbreaks of photosensitivity in sheep, one at Carnarvon, CP, and the other at Magaliesburg, Transvaal, *Pithomyces chartarum* was found to be present on the plants grazed by the sheep. The level of contamination of these plants by the fungus agreed with the level of contamination of the plants in the pastures at the Grootfontein College of Agriculture. *Pithomyces chartarum* was isolated in pure culture from this material and tested for the ability to produce toxin in pure cultures. Only 6 of 137 isolates tested proved capable of producing detectable amounts of toxin under these conditions.

Seedborne fungi

Species of fungi from 25 different genera have been identified on grass seeds during studies on the seedborne mycoflora of locally produced pasture grass. Among the important pathogenic fungi were *Colletotrichum* sp., *Drechslera* spp., *Fusarium* spp., *Phoma* spp. and *Septoria* spp. Some of the *Drechslera* spp. have not been recorded in South Africa before.

The occurrence of pathogenic fungi in samples of dry bean seed free of bacterial pathogens was monitored during the year. *Botrytis cinerea, Colletotrichum lindemuthianum, Fusarium* spp. and *Isariopsis griseola* occurred in some seeds of small numbers of samples.

The incidence of mycelial infection of seed of soybean and dry bean by white mould, *Sclerotinia sclerotiorum,* and the possible spread of this pathogen by seed were investigated. It was found that only 10 to 12 % of the seed was infected, even in poor samples taken from infected fields.

Curatorial work

A total of 131 new specimens were added to the mycological herbarium. These include four type specimens of a new pathogen of pine trees.

Phytophthora cinnamomi root-rot

A third biotype of *Agrobacterium tumefaciens,* which causes crown gall in areas along the Orange River where grapes are grown was identified. A list of *Phytophthora cinnamomi* hosts, with emphasis on those that occur in the Western Cape, has been compiled. Aliette (efosite - AL) and Terrazole (ethridiazol) gave good control of *Phytophthora* root-rot of pincushions (*Leucospermum* spp.) in the field and in pot trials, but Ridomil (metalaxyl) gave the best control in pot trials. Detailed studies of *Phytophthora* spp. in the Berg and Eerste Rivers of the Western Cape show that these fungi are most prevalent in these rivers from early summer to midsummer.

Inoculant against crown gall

This year a private company started manufacturing a peat inoculant, similar to legume inoculant, with which the seeds or roots of drupes can be treated to protect them against crown gall. The race of bacteria used in the inoculant is supplied to the manufacturer by the Plant Protection Research Institute and control is exercised over the quality of the inoculant, in the same way as legume inoculant is controlled. 2 000 to 3 000 units of the inoculant were sold during the first year.

Disease-free bean seed

A programme aimed at making disease-free bean seed available to the dry bean industry progressed well during the past year. The Institute purified foundation seed of 8 bean cultivars of pathogens and made it available for further multiplication in the field. Inspections of plantings of disease-free bean seed indicate that sufficient seed to supply farmers will be available in the foreseeable future.

Virus diseases of vines

Further results of an investigation into the possible elimination of vine fanleaf virus in vineyard soils by means of D-D soil fumigation against its nematode vector *Xiphinema index* indicate that the reinfestation of new plantings may take place within two seasons, despite deep fumigation. Although infestation in the deep-fumigated plots is relatively low (3 % as against 52 % in the shallow-fumigated plots), there is every indication that it will increase progressively.

Findings produced by the enzyme-linked immunoabsorbent assay (ELISA) during the past season showed that this technique is a notable aid in tracing soil-borne vine fanleaf virus. Over 3 000 samples were examined and the widespread incidence of vine fanleaf was established. One very important finding was that vine fanleaf virus was absent from a random proportional sample of the rootstock cultivars Jacquez, Richter 99 and 101-14 Mgt obtained from commercial vine nurserymen in the Western Cape. It was also found that ELISA is sufficiently sensitive to trace vine fanleaf virus in a batch sample in which one plant in 20 is infected.

Investigations into possible viral causation of deaths in young plantings of the red wine cultivars Shiraz, Tinta Barocca and Pinotage showed that grapevine corky bark virus plays an important part in deaths in Shiraz and Tinta Barocca vines on the rootstock Richter 99. Because vine leaf roll virus is also associated with this disease complex, the complex was confused in the past with a pathogenic condition known overseas as *flavescence dorée.*

An offshoot of the large-scale investigation of vineyards for the presence of vine fanleaf virus by means of the ELISA technique was that it was demonstrated that vine stem-pitting and vine enations are not related to vine fanleaf virus.

Legume inoculants

The present energy shortage and the consequent rise in the price of nitrogen fertiliser

have created a tremendous demand for suitable legumes, and the inoculants used with them, in order to cut out the need for nitrogen fertiliser, especially for pasture crops. An indication of this is the approximate sales figures for legume inoculants during the past four years. In 1975, 75 000 units of inoculant were marketed, in 1976/77 the figure was 100 000 units, in 1977/78 it was 150 000 and in 1978/79 200 000 units.

The nitrogen fixing unit of the Plant Protection Research Institute maintains strict control over the quality of inoculants. Only *Rhizobium* races selected by the unit may be used by the inoculant manufacturers and each gram of inoculant has to contain at least 500 million bacteria. The outstanding quality of the local inoculants is reflected by the fact that 66% and 85% respectively of the inoculants produced by the two top manufacturers in South Africa in 1978/79 contained over a milliard bacteria per gram.

The selection of new and more effective *Rhizobium* races continued. *Rhizobium* races for almost any type of legume farmers could possibly want to plant are now available in South Africa.

PHYTOSANITARY SERVICES

The importation of plant material for quarantine purposes

The following table provides a review of the plant material and the number of cultivars imported by the quarantine station at Stellenbosch during the past year.

Plant material	Number of cultivars
Peaches	37
Apricots	7
Plums	2
Apples	5
Quinces	1
Vine grapes	23
Strawberries	6
Figs	3
Blueberries	7
Rubus	3
Olives	1
Hops	11
Ornamentals	2
Roses	12
Herbs	1
Bamboo shoots	2
Shrub (*Acmena smithii*)	1
Total	**124**

Release of material from quarantine

In the past deciduous fruit and grape cultivars from recognised overseas sources were released to the Institutes concerned after the cultivars had been indexed on herbaceous plants in the glasshouse. It has now been decided in principle not to release that material before the first *field indexing* results are available. As a result comparatively little material was released from quarantine this year. The kinds of plants and number of cultivars (in brackets) released were as follows: peaches (9), table grapes (1), wine grapes (1), kiwi berries (1), hops (3), raspberries (1) and nuts (4). The cultivars were all handed over to the Institutes and, in the case of the peaches, to the SAPIO as well.

Available foundation material

The numbers of cultivars included in the foundation scheme during the past year are shown in the following table:

Kinds of plants	1978/79	Total to date
Apples	14	26
Pears	1	11
Quinces	-	1
Plums/Prunes	9	18
Almonds	4	6
Apricots	1	8
Peaches	12	20
Cherries	-	4
Vine rootstocks	3	17
Wine grapes	2	21
Table grapes	5	9
Total	**59**	**159**

These cultivars are available as foundation material and are issued for multiplication upon request.

Extensions and new developments - quarantine station at Stellenbosch

Extensions to the quarantine station complex were completed at the end of May 1979 and include a new wing with laboratories and growth chambers, and a new farm building.

The farm Vredenburg, which had been purchased by the Department of Agricultural Technical Services, was occupied on 1 February 1979.

Development of quarantine facilities at Buffelspoort

The provision of suitable facilities for the quarantine station is progressing favourably. Laboratory and glasshouse facilities are now becoming available, boreholes have been completed and a security fence around the farm is almost complete. A fibreglass glasshouse in which gauze compartments and a mist bed are being constructed will, together with the refrigeration facilities planned, soon enable the quarantine station to discharge its obligations efficiently.

Seed imports and vegetative propagating material were quarantined at Buffelspoort.

A planting of the national sunflower cultivar trial, which included three strains with incomplete phytosanitary certificates, was also established at Buffelspoort.

New records of plant diseases

According to the "Index of Plant Pathogens and the Diseases they Cause in Cultivated Plants in South Africa", compiled by G.J.M.A. Gorter, the following plant diseases have been reported for the first time in South Africa on the following crops: *Ustilago tritici* on the wheat species *Triticum aestivum* and *T. durum;* charcoal rot *Macrophomina phaseolina* on soya beans; *Rhizopus* headrot, *Phoma* black leg and *Verticillium dahliae* on sunflowers. Although these fungi were observed on these crops for the first time in South Africa, *Macrophoma phaseolina* and *V. dahliae* do occur locally on several other crops.

The following seed imports were subjected to quarantine: grasses - 1 533, vegetables - 41, oilseeds - 97, forage crops - 5 and other types - 7. Only 8 imports were destroyed on account of disease.

1 114 imports of vegetative propagating material were successfully subjected to quarantine.

LOCUST CONTROL

Brown locusts

No swarms of the brown locust *Locustana pardalina* Walker occurred during the 1978/79 season.

The drought in the central and eastern parts of the Karoo was less severe and the population numbers of solitary populations increased considerably.

It is interesting that 1978/79 is only the tenth season since 1889 in which no swarms requiring control occurred.

TECHNICAL ADVICE

The Senior Technical Adviser (Insecticides and Fungicides) to the Registrar, appointed under Act 36 of 1947, attended the 11th session of the FAO/WHO Codex Alimentarius Committee on pesticide residues in The Hague, in view of the importance of pesticide residues on our edible export commodities. Active participation in the activities of this Committee was maintained throughout the year.

Some 800 applications for registration and amendments to existing registrations of insecticides, fungicides and rodenticides have been reviewed and recommended for registration under Act 36 of 1947.

The annual departmental communication "A Guide to the Use of Pesticides and Fungicides in South Africa" (210 pages) was extended and updated.

AGRICULTURAL ENGINEERING

MECHANISATION DAYS

The highlights of the Division's activities during the year under review were the mechanisation days held on 16 and 17 August 1978.

By means of about 50 demonstrations and exhibits, extending over approximately 20 ha, the Division provided a tangible illustration of the most important aspects of its comprehensive activities. A few of the demonstrations and exhibits are described below.

Tractor testing laboratory

The Minister of Agriculture opened the highly sophisticated tractor testing laboratory at the Division's premises during the mechanisation days.

The laboratory will meet a major need in that it will determine the correct kW output and fuel consumption of tractors. This information will be very valuable to manufacturers and producers in that it will assist them to determine optimum methods of using tractors.

The testing laboratory consists of a large room in which tractor power take-off performance is determined, two rooms in which engine-power is determined and a central control room from which the tests are controlled and instrument readings are taken. A computer takes and processes the readings and the results appear directly in processed form.

There are only a few similar laboratories in the world. The South African laboratory is, however, unique in that it is the only laboratory where tractor power can be determined at a height of 1 400 m above sea-level. Over 70 % of the approximately 300 000 agricultural tractors in South Africa are operated at this height above sea-level. It is therefore necessary to carry out tractor tests in these conditions, since an increase in the height above sea-level reduces tractor performance.

Testing tractor safety frames

The equipment for testing the strength of tractor safety frames and cabins was commissioned at the same time. Impact-resistant frames and cabins for tractors are compulsory in several overseas countries because they can prevent loss of life.

An investigation was recently carried out into the approximately 2 200 fatal accidents with tractors that occur annually in South Africa and the extent to which effective frames and cabins

Mr Hendrik Schoeman, Minister of Agriculture, starts the first tractor tested by the Division of Agricultural Engineering. The photograph was taken during the official opening of the tractor testing laboratory

Most fatal tractor accidents on farms are caused by incorrect operation. Demonstrations of how accidents are caused and how they may be prevented were given at mechanisation days arranged by the Division of Agricultural Engineering at Silverton

could eliminate loss of life. It was clear from the investigation that about 25 % of the accidents could have been avoided had the tractors been equipped with safety frames and cabins of adequate strength.

The testing equipment for frames and cabins consists of a solid masspiece of 2 000 kg with which impact tests can be carried out on the back, front and sides of cabins. The equipment includes a pressure bar by means of which a compressive force double the mass of the tractor can be exerted on the front and back of the cabin.

Tractor accidents

One demonstration which attracted a lot of attention was the one in which tractors actually turned over as a result of incorrect use. Accidents cost the agricultural sector an average of R2 million a year. Fatal tractor accidents have doubled over the past 10 years.

Most of these accidents were the result of incorrect use of the tractors.

Alternative energy for agricultural purposes

Various models for harnessing solar, wind and hydraulic energy in order to cut costs and reduce the farmer's work load are being tested.

The use of solar energy for drying processes is by no means a revolutionary concept. The Division intends eventually to apply solar energy as a supplementary resource for this purpose.

Sunlight provides enough energy to serve as a pre-heater. If sufficient energy is to be collected during the day for the apparatus to function during the night as well, the collecting surface will have to be three times the size required for the day. A solar heating unit of that kind would not be economic because the cost of a collecting surface of that size would be too high.

However, the experimental unit built by die Division could function perfectly economically as a basic pre-heater or pre-drier.

Tractor performance

Various aspects of tractor performance were illustrated in a practical demonstration in which nine tractors participated.

Rolling resistance, which absorbs 30 % to 60 % of a tractor's power, can and should be kept to a minimum. This depends chiefly on the correct choice of tractor and implement combination, and on operating in the correct gear.

FUEL SAVING ON THE FARM

Since the sharp rise in fuel prices and the threat of diesel shortages have a marked effect on agricultural production, the Division launched a fuel-saving campaign during 1979 in co-operation with the SAAU, the Division of Agricultural Information and other interested bodies. Agriculture is the biggest single user of diesel, upon which it depends for 90 % of its energy requirements.

The intention is to provide information, through a series of publications and all other possible communications media, to enable farmers to keep the use of diesel on the farm to a minimum, without reducing production.

Diesel-saving could be effected in agriculture by:

- taking the necessary precautionary and maintenance measures to ensure that engines are always maintained at peak efficiency and calibrating diesel injection pumps correctly and regularly.
- choosing and utilising implements and tractors in such a way that optimum combinations are ensured. (Expert mechanisation planning plays a decisive part here).
- calibrating implements such as fertiliser spreaders, planters, spraying equipment etc. carefully.
- as far as is practicable, replacing diesel engines with other sources of energy such as electricity, coal, solar energy and wind.
- applying production practices that require as little diesel as possible. For instance, ploughing to a depth of 300 mm should be avoided if 200 mm would be sufficient.

SOIL CONSERVATION

The Division of Agricultural Engineering is still playing a leading part in the Department's soil conservation campaign, particularly with regard to matters that concern engineering.

Soil conservation works

The Subdivision at Aliwal North, which is responsible for the planning and construction of State soil conservation works, completed 20 new works to the value of R800 000 during the year under review, and repairs to the value of R200 000 were done to 17 works. All the works are situated in the Orange River catchment.

In all 314 similar State works have been completed on private farms since the Soil

Pneumatic planters are a relatively new development in mechanisation. These planters were tested and demonstrated by the Division of Agricultural Engineering

Conservation Act came into operation in 1946. This is in addition to the approximately 200 works constructed on State land in various parts of the country.

The success of these works depends largely on the application of biological measures in the watercourse soils where these works are constructed. These measures mainly comprise the planting of suitable plants in the dongas and controlled grazing of the veld. It is very important that these measures should be applied as soon as the works are completed.

Unfortunately the owners of the land where these works were constructed during the past few years have given very little attention to planting and the provision of camps. Consequently very little progress is being made with the stabilisation of the eroded areas. It was therefore decided that the camping off of the watercourse soils where these works are constructed and the planting of vlei vegetation should also be undertaken by the State.

Soil conservation guides

The most experienced soil conservation engineers and most advanced technicians from the Regions met at Silverton for two weeks, under the aegis of the Division, in order to work out a programme for drawing up suitable soil conservation guides for all officers concerned with the design of soil conservation works.

Comprehensive guides have already been compiled and are in the final stage of preparation.

Run-off control planning

Run-off control planning under the guidance of soil conservation engineers is attracting increasing interest. Although the application of this conservation measure is increasing in all the Regions, the communal works in the Highveld Region deserve special mention.

The following are a few examples that illustrate the nature and extent of planning in this field on the Highveld:

- The planning of the Dundas development area near Frankfort has revealed that about 90 waterways, 700 km of contour banks, 7 inlet structures and 12 stone barricades will have to be constructed in the area.
- Although the Highveld Region concentrates on selected development areas, about 3 700 isolated farm units were also planned. On average, the following works will be required per farm: 4 waterways of 500 m each, 35 km of contour banks and 2 inlet structures (to conduct flood waters safely from a higher to a lower level).

IRRIGATION

Working in co-operation with other interested bodies, the Irrigation Engineering Subdivision made a real contribution during the year under review to the Department's campaign to promote the efficient utilisation of water in agriculture. In addition to numerous appearances at farmers' days, they made the following contributions:

- A visiting irrigation engineer from the USA, Dr H.R. Haise, developed the Haise flow control valve during the three months he worked at the Division. This valve ensures that a predetermined, constant stream of water flows from a storage dam, irrespective of the pressure head of the water in the storage dam. This valve meets a long-felt need. It is reliable and its construction and action are simple and practical.
- Thirty-five newly established farmers farming below the P.K. le Roux Dam were assisted with the design and choice of mechanised sprinkler equipment systems. The average cost per system is about R60 000. Some of the farmers who installed these systems reported that their labour was as low as 10 man hours per week for 60 ha under irrigation.

  An interesting finding is that low pressure, high precipitation centre pivot systems are undesirable owing to the severe flooding and uneven distribution of water they cause.
- Underground drainage systems were designed and installed on 120 irrigation farms. Where necessary, technical advice and assistance were given during construction. The average cost of installing these systems was around R4 000 per farm.
- In collaboration with the Department of Water Affairs and the Soil and Irrigation Research Institute, the Division presented a four-week irrigation course to 130 technicians working for the Government, co-operatives and private firms. In all 60% of the persons who attended the course were successful and received their certificates. The course is regarded as an important breakthrough in ensuring that irrigation schemes are scientifically designed.
- Thirty-two irrigation farms in the Fish River Valley, covering a total area of about 2 000 ha, were comprehensively planned for flood irrigation.

SPRAY AND PLUNGE DIPS

A comprehensive system of plans with specifications for spray and plunge dips were compiled by the Division to make provision for the large number of enquiries on the subject. With regard to spray dips, information is available on making an improved spray nozzle which is economical, and an efficient pipeline layout to ensure more thorough wetting of animals.

Sheep dip

The Division developed and drew up a revised plan for a round sheep dip with a view to the new regulations which make the dipping of sheep compulsory.

Refrigerated bulk milk tanks

Refrigerated bulk milk tanks were tested in co-operation with the Animal and Dairy Science Research Institute at Irene, at the request of the Dairy Control Board. The tests were aimed mainly at tanks of the smaller, portable type which are not covered by the current testing procedure for fixed tanks. It was possible to identify certain defects in the tanks.

The Division is also engaged in developing a simplified testing procedure for all milk tanks in South Africa.

During the draining program at Vaalharts and other irrigation schemes, various machines which are used for laying pipes, were tested. This machine digs ditches (up to 2 m deep), lays plastic drainage pipes, covers it with gravel and refills the ditch. Up to 3 m of piping per minute can be laid

Animal waste

During the year under review engineers of the Division were intensively concerned with the formulation of the regulations under the new Health Act, 1977, with regard to the handling and management of waste from intensive animal feeding systems. A considerable amount of attention was given to the formulation of guidelines for creating the necessary facilities for the handling of waste from these systems.

Poultry housing

A new poultry house with a mono-pitched roof was designed by the Division. The characteristics of this design are:

- An unobstructed floor area for easy cleaning.
- Provides natural ventilation by means of steel louvres.
- Easy conversion of the structure for other purposes if it is no longer being used for poultry.

These structures will be evaluated by means of experiments in the near future, in co-operation with all interested bodies.

COMPOST-MAKING BY MEANS OF ARTIFICIAL AERATION

In order to make good compost within a reasonable period, the compost material requires to be turned regularly, 4 or 5 times; this is also important from the point of view of preventing unpleasant odours. The operation is usually carried out with the aid of a tractor and a front-end loader, but the cost of turning the compost is about R1 per ton per turning, i.e. R4 to R5 per ton, which makes the cost of compost-making excessive.

Officers of the Natal Division developed a method, in co-operation with the University of Natal, by means of which aeration can be carried out artificially with the aid of a fan and a tunnel running the length of the compost heap. The system is undergoing testing and scientific evaluation at present, but everything points to its having great potential for producing good compost at a low cost.

GRAIN SILOS

Officers of the Division act as technical advisers to the Grain Silo Committee in respect of the State Loan Scheme, by means of which grain silo space is provided.

During the year under review 14 grain silo projects were undertaken; they will provide 824 000 m^3 of new grain silo capacity at an estimated cost of R19,5 m, i.e grain silo space will cost about R24/m^3. Thirteen million m^3 of grain silo space has already been constructed under the loan scheme and the estimated requirement by 1984 is 20 million m^3. This means that 7 million m^3 of grain silo space will have to be constructed during the next 5 years, at an estimated cost of R200 m.

During the year under review a very successful grain silo seminar was held at the offices of the Division at Silverton, the purpose being to prevent explosions in grain silos. This was a follow-up to an international symposium held in July 1978, at which the Division was represented. In all 70 persons, including representatives of co-operatives, the Railways, the SABS, the control board concerned, consulting engineers, contractors, and other interested persons attended the meeting.

Following the meeting a working group was formed to compile guides for use by grain silo and milling enterprises, in the Republic. The guides will cover good housekeeping, management, training, design standards and other related matters.

GLASSHOUSES FOR RESEARCH STATIONS

The Division is responsible for the design of these structures and for providing technical assistance and advice where necessary.

During the year no less than R300 000 was spent on the improvement of existing glasshouses and the construction of new ones. This includes two glasshouses for the Citrus and Subtropical Fruit Research Institute at Nelspruit, two glasshouses for the Tobacco Research Institute at Kroondal and one glasshouse with ten compartments for the Olko Laboratories at Roodeplaat, Transvaal Region.

ADMINISTRATIVE MATTERS

THE ESTABLISHMENT

POSTS

The following is an indication of the posts in the Department (in the respective Divisions into which posts are divided in the Public Service) as at 30 June 1979, as well as of the number of vacancies in each Division, compared with the position during the corresponding period of the previous year:

Division	1978-06-30 Authorised posts	Vacant posts Number	%	1979-06-30 Authorised posts	Vacant posts Number	%
Administrative	190	12	6,3	193	21	10,9
Clerical	514	49	9,5	538	60	11,2
Professional	1 470	232	15,8	1 504	260	17,3
Technical	1 683	268	15,9	1 779	292	16,4
General A	81	10	12,3	78	9	11,5
General B	2 235	329	14,7	2 304	359	15,6
Non-classified	190	22	11,6	157	28	17,8
Posts additional to the authorised establishment	86	44	51,2	66	34	51,5
Total	**6 449**	**966**	**15,0**	**6 619**	**1 063**	**16,1**

Increase/decrease in the number of authorised posts in the various Divisions over the past five years:

Division	1975-06-30	1976-06-30	1977-06-30	1978-06-30	1979-06-30	Total % increase or decrease
Administrative	164	163	172	190	193	+ 17,7
Clerical	481	494	511	514	538	+ 11,9
Professional	1 494	1 501	1 459	1 470	1 504	+ 0,7
Technical	1 586	1 609	1 660	1 683	1 779	+ 12,2
General A	85	84	81	81	78	- 8,2
General B	2 216	2 220	2 217	2 235	2 304	+ 3,9
Non-classified	171	150	187	190	157	- 8,2
Total	**6 197**	**6 221**	**6 287**	**6 363**	**6 553**	**+ 5,7**

IMPORTANT ORGANISATIONAL AND ESTABLISHMENT CHANGES

1. A new extension ward office at Joubertina (Winter Rainfall Region) was opened on 1 October 1978.
2. The creation of a foot-and-mouth division at the Veterinary Research Institute was approved with effect from 1 April 1979.
3. The establishment of the Finance Division of the Department was reorganised and strengthened at the control and management level with effect from 1 May 1979, to make provision for the application of the existing financial management system. The application of this system also resulted in administrative/clerical changes to the establishment in the following Departmental institutions:
   Veterinary Research Institute
   Botanical Research Institute.
4. The Administration Subdivision of the Division of Agricultural Information was reorganised to adapt to changed service requirements.
5. A Datametric Services Section, with provision for an adequate number of posts, was established. It is attached to the Professional Auxiliary Services Panel and will provide a datametric service for the Department.
6. In view of the new conditions for liaison officers recommended by the Public Service Commission with effect from 1 May 1979, a Liaison Services Subdivision was introduced at the various agricultural regions and the following research institutes:
   1. Citrus and Subtropical Fruit
   2. Animal and Dairy Science
   3. Oenology and Viticulture
   4. Fruit and Fruit Technology
   5. Tobacco
   6. Horticulture
7. The establishment of the Soil and Irrigation Research Institute was reorganised with effect

STAFF GAINS AND LOSSES

Division	1977-07-01 to 1978-06-30 Gains**	Losses*	%	1978-07-01 to 1979-06-30 Gains**	Losses*	%
Administrative	8	12	- 50,0	17	13	+ 23,5
Clerical	127	130	- 2,4	133	129	+ 3,0
Professional	139	115	+ 17,3	156	130	+ 16,7
Technical	193	183	+ 5,2	256	228	+ 10,9
General A	16	16	-	12	20	- 66,7
General B	600	612	- 2,0	664	644	+ 3,0
Non-classified	62	39	+ 37,1	42	58	- 38,1
Total	**1 145**	**1 107**	**+ 3,3**	**1 280**	**1 222**	**+ 4,5**

**By "Gains" is meant all officers gained by every Division, i.e. appointments from outside, promotions and translations from one Division to another and transfers from other Departments.
*By "Losses" is meant all officers lost by various Divisions (individually or jointly), including translations and promotions to other Divisions and cases where persons left the service for good, such as resignations, deaths, retirements, abscondences and dismissals.

from 1 March 1979 in accordance with changed service requirements.

8. Owing to an increase in the administrative/clerical work load, the Statutory Control Subdivision, Division of Technical and Legal Matters, Administrative Branch, at Head Office was reorganised and expanded with effect from 1 March 1979 to adapt to changed conditions.

STAFF CHANGES (SENIOR STAFF)

RETIREMENTS

Dr W.A. Verbeek, Secretary for Agricultural Technical Services, upon reaching the age limit, left the service on pension on 1 January, 1979, after a career which extended over almost 40 years and during which he distinguished himself in various fields.

RETIREMENT ON MEDICAL GROUNDS

Owing to ill health, the following two senior officers left the service of the Department after long careers:

Name	Rank	Institution to which attached	Years of service	Date of retirement
Mr J.S.A. Landrey	Assistant Director	Animal and Dairy Science Research Institute	28	1978-10-31
Mr J.H. Stapelberg	Deputy Director	Eastern Cape Region	18	1979-01-31

DEATHS

The Department regrets to report the deaths of the following senior officers:

Dr F.J. Kok, Deputy Director, Highveld Region, on 1 September 1978; and
Dr W.H.B. Buhr, Assistant Director: Division of Veterinary Services, Natal, on 25 August 1978.

PROMOTIONS

Name	Rank	Institution	Date of promotion
Dr D.W. Immelman	Secretary	Agricultural Technical Services	1979-01-01
Dr J.E. Erasmus	Chief Director	Directorate, Agricultural Technical Services	1979-01-01
Dr W.J. Hugo	Chief Director	Directorate, Agricultural Technical Services	1979-02-01
Dr D.J. Rossouw	Director	Tobacco Research Institute	1978-09-01
Mr C.R. Baard	Director	Division of Soil Protection	1979-05-01
Dr W. P. Grobbelaar	Director	Summer Grain Centre	1979-06-01
Mr T.E. Skinner	Director	OFS Region	1979-06-01
Dr J.E. Van Niekerk	Deputy Director	Highveld Region	1978-10-01
Dr N.J. Robbertse	Deputy Director	Head Office, Professional Auxiliary Services Panel	1979-05-01
Dr W.J. Pienaar	Deputy Director	Tobacco Research Institute	1979-03-01
Mr D.J. van Z. Smit	Deputy Director	Karoo Region	1979-05-01
Dr C.E.G. Schutte	Deputy Director	Soil and Irrigation Research Institute	1979-05-01
Dr A.D. Venter	Deputy Director	Eastern Cape Region	1979-05-01
Dr D.E. Osbourn	Assistant Director	Division of Veterinary Services	1978-09-01
Dr R.R. van der Veen	Assistant Director	Division of Veterinary Services	1978-09-01
Dr P.J. Posthumus	Assistant Director	Division of Veterinary Services, Natal	1978-10-01
Mr G.C. Green	Assistant Director	Soil and Irrigation Research Institute	1978-11-01
Mr B.R. Grobler	Assistant Director	Animal and Dairy Science Research Institute	1978-11-01
Mr J. Hechter	Control Programmer	Head Office, Data Processing	1978-11-01

TRAINING AND STAFF DEVELOPMENT

BURSARY SCHEME

The Department administers a bursary scheme for under-graduate study at local universities from funds donated by the various control boards. The following table shows the number of bursaries awarded since 1976, and the monetary value:

Grants	Number of bursaries		Studies completed	Total monetary value of new grants
	New grants	Total		
Grants up to 1976	38	202	34	R 98 000
Grants up to 1977	46	214	31	R137 500
Grants up to 1978	33	216	31	R 86 500
Grants up to 1979	37	222	35	R102 500

IN-SERVICE TRAINING

In order to promote efficiency and foster skills and motivation, staff serving on the establishment of the Department underwent the following training:

	Number of offices involved
Administrative courses:	
Induction	116
Supervision	187
Management course for managerial officers	80
Merit assessment	100
Functional courses:	
Budgeting by objectives	46
Irrigation course	28
Mechanisation	42
Stock inspection	95
Fertilising	34
Programme planning (extension)	101
Soil classification	10

FORMAL TRAINING

Officers of the Department are afforded ample opportunity to improve their academic qualifications at Government expense, for purposes of appointment, promotion and also self-development, is evident from the following data:

Diploma training: Technicians and meat inspectors		
	A	
Undergoing training		192
Training completed		52
Formal in-service training: Meat examiners		
Undergoing training		8
Training completed		5
Post-graduate study: (Local universities):		
Exempted for study (1979):	B.Sc. (Hons.)	3
	B. Agric. (Hons.) (Inst/Agrar)	7
	B.Sc. (Agric.) (Hons.)	22
Studies completed (1978):	B. Agric. (Hons.) (Inst/Agrar)	8
	B.Sc. (Agric.) (Hons.)	22
Diploma training (Optional)		
Public Administration, State Accounts and Finance, Cost Accounting		10

VII. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE

(Agricultural Building, Beatrix Street/Private Bag X116, Pretoria)

Management

Dr D.W. Immelman: Secretary

Directorate of Agricultural Technical Services

Dr D.J. Agenbach: Chief Director (Chairman)
Dr J.C. Strydom: Chief Director (Horticulture)
Prof. S.A. Hulme: Chief Director (Crops and Pastures)
Dr J.E. Erasmus: Chief Director (Agricultural Resource and Farming Development)
Dr W.J. Hugo: Chief Director (Animal Production)

Administrative Branch

Mr B.W. Viljoen: Senior Deputy Secretary

Personnel and Training

Mr J.C. Visser: Deputy Secretary
Mr P.M.A. Spreeth: Under Secretary (Personnel Administration)

Auxiliary Services

Mr L.J. Botha: Deputy Secretary
Mr G.J. Smit: Data Processing Manager
Mr M.D. Meyer: Under Secretary (Sundry Services)
Mr G.P. Kleinhans: Chief Work Study Officer

Technical and Legal Affairs

Mr B.J. Dreyer: Deputy Secretary
Mr A.C. Bosch: Under Secretary (Technical Administration)
Mr C.S. de Villiers: Under Secretary (Statutory Control)
Mr P.J. Loubser: Under Secretary (Legislation and Parliamentary)
Mr G.M. Botha: Under Secretary (Foreign Affairs)

Finance

Mr P.F. Nortjé: Chief Accountant
Mr J.J. Lombard: Assistant Chief Accountant

Objective Budgeting

Mr H.F. van Zyl: Under Secretary

Departmental Inspectorate

Mr H.J. Kriek: Inspector

(b) SUBDIRECTORATE

Dr A.D. Nieuwoudt: Director (Co-ordination of Irrigation)
Dr J.J. du Toit: Deputy Director (Co-ordination of Agricultural Research)
Mr R.W. Nott: Deputy Director (Co-ordination of Agricultural Resource Development)
Mr A.B. Bridgens: Deputy Director (Secretary-General, SARCCUS)
Dr J.P. Jooste: Deputy Director (Biometry Services)
Dr N.J. Robbertse: Assistant Director (Training)

Crops and Pastures Institute

Prof. A.J. Pienaar: Director
Mr T.E. Skinner: Deputy Director
Dr J.W. Snyman: Assistant Director
The Institute does not itself engage in research but gives guidance to research workers engaged in research in the different regions on summer grain, winter grain, other agricultural crops, pastures and pasture crops, and co-ordinates all research in this connection. The co-ordination of weed and poisonous plant research at the national level, as well as supplying technical information in connection with weedicides, is also a function of the Institute.

(c) FOREIGN REPRESENTATIVES

Paris (South African Embassy, 59 Quai D'Orsay, 75007 Paris, France)
Dr J.G. Boyazoglu: First Counseller (Agricultural Technical)
Mr J.A. Thomas: Counsellor (Agricultural Technical)
Mr J.U. Rietman: Attaché (Agricultural Technical)

London (South African Embassy, Trafalgar Square, London WC2N 5DP, England)
Dr A.C. Myburgh: Counsellor (Agricultural Technical)

Washington (South African Embassy, 3051 Massachusetts Avenue NW, Washington DC 20008, USA)
Dr A.D. Venter: Counsellor (Agricultural Scientific)
Dr J.E. Nel: Attaché (Agricultural Scientific)

Canberra (South African Embassy, Rhodes Place, Yarralumla, Canberra ACT 2600, Australia)
Mr J.H. I'Ons: Counsellor (Agricultural Technical)

(d) SPECIALISED RESEARCH INSTITUTES

Soil and Irrigation Research Institute
Belvedere Street, Private Bag X79, Pretoria

Dr M.C. du Plessis: Director
Dr C.N. MacVicar: Deputy Director (Pedology and Irrigation Planning)
Dr C.E.G. Schutte: Assistant Director (Analyses)
Mr J.F. Eloff: Assistant Director (Pedology)
Mr J.A. Stofberg: Assistant Director (Irrigation Planning)
Dr A.L. du Pisani: Assistant Director (Agricultural Meteorology)
Dr G.C. Green: Assistant Director (Soil and Agricultural Water Research)

The Institute is responsible for the classification of the soil and climatic resources of the Republic and also basic research with regard to the physical and chemical characteristics of soils on a national level. Soil surveys for irrigation projects and investigations into physical soil characteristics are also undertaken - particularly where brack and waterlogging conditions occur. In addition, the Institute undertakes chemical soil, water and plant material analyses, not only for this Department but for other State Departments, provincial administrations and other bodies. The Institute is also responsible for the inspection and analysis of fertilisers, stock feeds, stock remedies and agricultural remedies in terms of Act 36 of 1947. It is also responsible for basic irrigation research, and the agricultural evaluation and planning of irrigation areas. All agricultural meteorological research and data collection also falls under this Institute.

Plant Protection Research Institute
Agricultural Building, Beatrix Street,
Private Bag X134, Pretoria

Dr I.H. Wiese: Director
Dr D.P. Annecke: Deputy Director
Mr I.G. Venter: Assistant Director (Locust Control)
Mr H.P. van Heerden: Assistant Director (Phytosanitary Services)
Dr B.W. Strydom: Assistant Director (Plant Pathology/Microbiology)
Mr D.J. Engelbrecht: Assistant Director (Virus Research)

The Institute is broadly responsible for advanced research and research at the national level on plant pathology, insect and animal pests and their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagating material from viruses, honey-bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests and weeds. The Institute is also responsible for the examination and control of imported plant material and the control of migratory locusts. The Institute uses the research stations and experimental farms at Rietondale (Pretoria), Buffelspoort (Marikana), Fleurbaix and the quarantine station (Stellenbosch), as well as the research units for the control of prickly pear and jointed cactus at Uitenhage and forest pests at Rosebank (Cape Town).

Botanical Research Institute
Private Bag X101, Pretoria

Dr B. de Winter: Director
Dr D.J.B. Killick: Deputy Director
Dr D. Edwards: Assistant Director

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanical Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute
Private Bag X11208, Nelspruit

Dr J.H. Grobler: Director
Mr A. van Oostrum: Deputy Director
Dr D.L. Milne: Assistant Director

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs. The Institute also undertakes research at the research stations and experimental farms Addo (Eastern Cape), Burgershall, Citrusdal, East London, Friedenheim, Levubu (Louis Trichardt), Messina and Rustenburg.

Horticultural Research Institute
Private Bag X293, Pretoria

Mr E. Strydom: Director
Dr J.T. Meynhardt: Deputy Director
Mr O.J. Olivier: Assistant Director

The Institute is responsible for all applied and fundamental research and extension on vegetables, cut-flowers, ornamental plants and shrubs throughout South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The Institute controls research stations for vegetables, flowers, decorative plants, table grapes and deciduous fruit research at Roodeplaat in the Transvaal Middleveld and for cherry and deciduous fruit at Emperani, near Ficksburg. In addition the Institute undertakes research on vegetables in the winter rainfall area at Elsenburg, Outeniqua and Lutzville, as well as at Glen in the Orange Free State, at Nelspruit in the Transvaal Lowveld, at Cedara in Natal and at Addo in the Eastern Cape. Research on

indigenous flowers, mainly proteas, is undertaken at Elsenburg and at the Tygerhoek Research Station near Riviersonderend.

Tobacco Research Institute
Kroondal, Private Bag, Rustenburg

Dr D.J. Rossouw: Director
Dr W.J. Pienaar: Deputy Director
Dr M.P. Lamprecht: Assistant Director
The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research Stations and experimental plots at Groblersdal, Hartebeespoort (Brits), Nelspruit, Oudtshoorn, Potgietersrus and Stellenbosch.

Veterinary Research Institute
Post Office Onderstepoort, Pretoria

Dr K.E. Weis: Director
Dr R.D. Bigalke: Deputy Director
Dr T.W. Naudé: Deputy Director
Dr C.J. Howell: Assistant Director (Parasitology and Reproduction)
Dr D.W. Verwoerd: Assistant Director (Virus Diseases)
Dr C.M. Cameron: Assistant Director (Bacterial and Protozoic Diseases)
Dr J.G. Pienaar: Assistant Director (Pathology)
Dr B.J. Erasmus: Assistant Director (Professional/Technical Auxiliary Services)
Dr L.A.P. Anderson: Assistant Director (Biochemistry)
Mr F. Visser: Special Grade Control Technician (Vaccine Production)
Mr K.P. Naudé: Assistant Director (Administrative)
The Institute is concerned with research on diseases of stock and game (infectious and others, including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute
Private Bag X2, Irene

Dr J.H. Hofmeyr: Director
Dr J.C. Oosthuizen: Director (Personal)
Dr P.E. Lombard: Deputy Director
Mr B.R. Grobler: Assistant Director (Stock Improvement)
Dr J.G. Cloete: Assistant Director (Animal Physiology and Nutrition)
Mr W.C.J. Viljoen: Assistant Director (Poultry Science)
Dr J.H. Labuschagne: Assistant Director (Dairy Research)
Dr H.A. Lück: Assistant Director
The Institute, at various centres throughout the country, undertakes at the national level performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig-testing stations at Irene, Cedara and Elsenburg, and bull-testing stations at Queenstown and Omatjenne (South West Africa).

Fruit and Fruit Technology Research Institute
Private Bag X5013, Stellenbosch

Dr P.G. Marais: Director
Dr A.J. Heyns: Director (Personal)
Dr J.H. Terblanche: Assistant Director (Research/Table grapes, Horticulture, Plant Improvement, Plant Pathology and Entomology)
The Institute is responsible for research on deciduous fruit, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products. The Institute further renders a radiation and radio-isotope service in connection with agricultural problems in the winter rainfall complex. The Institute controls the research stations and experimental farms at Groot Drakenstein (Bien Donné), Citrusdal, De Doorns, Elgin, Langkloof, Paarl and Robertson.

Oenological Viticultural Research Institute
Private Bag, Stellenbosch, C.P.

Dr J. de V. Burger: Director
Dr J. Deist: Deputy Director
Dr P.C. van Rooyen: Assistant Director
Mr C. Kok: Assistant Director
The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The Institute controls the historic wine farm Groot Constantia.

(e) DIVISIONS

Division of Agricultural Engineering
Private Bag X515, Silverton

Mr J.J. Bruwer: Director
Mr C.T. Crosby: Chief Engineer

Dr B. van D. Boshoff: Chief Engineer
Mr P.J. Pienaar: Assistant Chief Engineer (Soil Conservation Works - Aliwal North)
Mr F.J.C. Hugo: Assistant Chief Engineer (Mechanization: Plant Production)
Mr J. Veenstra: Assistant Chief Engineer (Mechanization: Animal Production)
Mr C.J. van Schalkwyk: Assistant Chief Engineer (Farm Development)
Mr I. Scheepers: Assistant Chief Engineer (Winter Rainfall Complex - Stellenbosch)
Mr J.H. Eckhard: Assistant Chief Engineer (Irrigation Engineering)
Mr H.W.P.W. Struck: Assistant Chief Engineer (Soil Conservation Engineering)
The Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Division of Agricultural Information
Agricultural Building, Private Bag X144,
Beatrix Street, Pretoria

Mr R.J. van Niekerk: Director
Mr L.L. Lötter: Assistant Director (Information)
Mr Q. Momberg: Assistant Director (Publications)
The function of the Division is the distribution of agricultural information by the mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control
Agricultural Building, Beatrix Street, Pretoria

Mr J.F. van Wyk: Director
Mr D.C. Lourens: Deputy Director
Mr A.J. Cronjé: Assistant Director (Quality Control)
Mr L.J. Grobler: Assistant Director (Inspection and Control Services)
The functions of this Division include the protection of propagation material and the assurance of its quality. The Division administers the Seeds Act (Act 28 of 1961), the Plant Breeders' Rights Act (Act 22 of 1964) and the Agricultural Pests Act (Act 3 of 1973).

Division of Soil Protection
Agricultural Building, Beatrix Street,
Private Bag X120, Pretoria

Mr C.R. Baard: Director (w.e.f. 1979-05-01)
Mr J.L. Vosloo: Deputy Director
Mr M.L. Heyns: Assistant Director (Land and Weed Control)
Mr T. Brenkman: Assistant Director (Administrative)
The Division is responsible for the administration of the Soil Conservation Act (Act 76 of 1969), the Weeds Act (Act 42 of 1937), and the Subdivision of Agricultural Land Act (Act 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Division of Veterinary Services
Transvaal Agricultural Union Building,
28 Struben Street, Private Bag X138, Pretoria

Dr J.P. van der Merwe: Director
Dr J.D. Coetzee: Deputy Director
Dr J.M. Erasmus: Deputy Director
Dr A. van Heerden: Assistant Director (Major Disease Eradication Schemes and Notifiable Diseases)
Dr G.C. Dent: Assistant Director (Import and Export Control, Bantu Veterinary Services and Border Control and Nagana Control)
Dr P.P. Bosman: Assistant Director (Regional Diagnostic Services, Training, Extension, Non-notifiable Diseases, A.I. Services, Liaison and Publications)
Dr C.W.A. Belonje: Assistant Director (Eastern Cape and Karoo Region - East London)
Dr A.E. Gillespie: Assistant Director: (Meat Hygiene and Related Matters)
Dr W.M.H. Löwe: Assistant Director (Highveld Region - Potchefstroom)
Dr E.O. le Riche: Assistant Director (Winter Rainfall Region - Stellenbosch)
Dr R.R. van der Veen: Assistant Director (Free State Region - Bloemfontein)
Dr F.B.W. du Casse: Assistant Director (Transvaal Region - Pretoria)
Dr L.R. Hurter: Assistant Director (Northern and Eastern Transvaal Region - Pietersburg)
Dr C.J. Coetzee: Assistant Director (Stock Disease Control)
Dr H.H.P.A. Schneider: Assistant Director (SWA Region, South - Windhoek)
Mr F. Huisman: Assistant Director (Administrative)
The Assistant Directors of the Regions are under the direct control of the Director. The Division has a specific task in regard to animal health as laid down in the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956) and regulations promulgated in terms thereof. The Division guards against the

introduction of diseases by erecting, patrolling and maintaining game- and cattle-proof fences on the borders of the Republic and South West Africa and by controlling animal imports. For domestic protection regular inspections of all stock are carried out. The promotion of animal health schemes to eradicate certain diseases and animal health in general enjoy high priority. The Division also has four Regional Veterinary Laboratories throughout the Republic and South West Africa for local investigation of stock losses, problems relating to animal health and suboptimal production and reproduction. In terms of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), the Division is responsible for the promotion and maintenance of hygiene in cattle slaughterings and handling of meat and animal products, for preventing the transmission of diseases to human beings and animals by disease-infected animals, meat or animal products, for preventing cruelty to animals slaughtered at abattoirs and for controlling the importation of meat.

(f) AGRO-ECOLOGICAL REGIONS

The eight Regional Organisations of the Republic, as well as of South West Africa, are responsible within their respective geographical areas, for the planning, development, promotion and application of farming systems based on optimal land utilisation.

Each of these organisations provides an extension service in which the soil concervation effort is integrated and which also covers every aspect of farming. The research services are directed to the collation and releasing of scientific knowledge for the optimal utilisation of the natural agricultural resources. The research personnel are also responsible for specialist extension work and for supplying training services to the agricultural colleges.

Eastern Cape Region
P.O. Box 233, Queenstown

Mr H.S. Niehaus: Director
Mr J.H. Stapelberg: Deputy Director
Mr J.L. van der Walt: Assistant Director (Research)
Mr B.J. Krige: Assistant Director (Extension)
Research stations: Dohne (central research station) at Stutterheim, and Bathurst (Port Alfred). A number of experiments are also conducted at East London.

Free State Region
Agricultural College, Glen

Mr T.E. Skinner: Director (w.e.f. 1979-06-01)
Mr G.W. Oosthuysen: Deputy Director
Dr P.J. Niemann: Assistant Director (Research)
Mr D.J. Hattingh: Assistant Director (Extension)
Mr P.F. du Toit: Assistant Director (Research)
Mr G.W. Long: Assistant Director (Administrative)
Glen College of Agriculture: Research stations and experimental farms: Glen (central research station), Armoedsvlakte (Vryburg), Koopmansfontein (Barkly West), Rietrivier (Herbert), Sandvet, Sydenham, Upington Complex and Vaalharts (Jan Kempdorp).

Highveld Region
Private Bag X804, Potchefstroom

Dr J.D. Slabber: Director
Dr J.E. van Niekerk: Deputy Director
Dr W.P. Grobbelaar: Deputy Director (Summer Grain Centre - Potchefstroom
Mr J. de Kock: Assistant Director (Summer Grain Centre - Potchefstroom)
Mr J.D. Basson: Deputy Director (Small Grain Centre - Bethlehem)
Mr G.J. Carstens: Assistant Director (Small Grain Centre - Bethlehem)
Mr K.W. Pakendorf: Assistant Director (Small Grain Centre - Bethlehem)
Dr J.J. Coetzee: Assistant Director (Extension)
Mr M.C. Walters: Assistant Director (Research)
Mr S.W.B. van Rensburg: Assistant Director (Administrative)
Grootfontein College of Agriculture. Research stations and experimental farms: Potchefstroom complex (central research station), Bethlehem and Swartrand (for gousiekte research) at Ventersdorp.

Karoo Region
Agricultural College,
Grootfontein, Middelburg, CP

Dr P.W. Roux: Director
Mr D.J. van Z. Smit: Deputy Director
Mr J.A.A. Baard: Assistant Director (Research)
Dr A.J. Siepker: Assistant Director (Extension)
Grootfontein College of Agriculture. Research stations, experimental farms: Grootfontein, Middelburg, CP (central research station), Carnarvon, Tarka Conservation Area, Hales Flats and Jansenville

Natal Region
Private Bag X9021, Pietermaritzburg

Mr P. Hildyard: Director
Mr R.H. Peard: Deputy Director
Dr J.W.C. Mostert: Assistant Director (Research)
Dr D.M. Scotney: Assistant Director (Extension)
Cedara College of Agriculture. Research stations, experimental farms: Cedara (Central Research Institute), Drakensberg Complex, (Estcourt); Northern Natal (Dundee); Kokstad and Pongolapoort (Makatini).

South West Africa Region
Private Bag X13184, Windhoek

Dr L. Mostert: Director
Mr J.H. Loubser: Deputy Director
Mr C.H. de Klerk: Assistant Director (Extension)
Dr P.J. le Roux: Assistant Director (Research)
Neudam College of Agriculture. Research stations, experimental farms: Gellap 'Ost (Keetmanshoop), Hardap (Mariental), Kalahari (Stampriet), Neudam (Windhoek), Omatjenne (Otjiwarongo), Sandveld (Gobabis), Sonop (Grootfontein) and Uitkomst (Grootfontein).

Transvaal Region
Agrivaal Building,
Cor Edmund and Hamilton Streets
Private Bag X180, Pretoria

Mr D.F. de Wet: Director
Mr S.J. Gericke: Deputy Director
Dr M.K.S.L. von La Chevallerie: Assistant Director (Research)
Mr W.H. de Vos: Assistant Director (Extension)
Mr J.A. van Niekerk: Assistant Director (Administrative)
Research stations, experimental farms: Roodeplaat (central research station), Rietondale, Soutpan (Pretoria), Athole (Amsterdam), Loskop (Groblersdal), Mara (Louis Trichardt), Messina, Nooitgedacht (Ermelo) and Towoomba (Warm Baths).

Winter Rainfall Region
J.S. Marais Building, Private Bag X5023,
Stellenbosch

Dr J. Serfontein: Director (w.e.f. 1979-06-07)
Dr P.J.S. Pieterse: Deputy Director
Mr A. Viljoen: Deputy Director
Mr A.F. Kriel: Assistant Director (Extension)
Mr H.C. du Preez: Assistant Director (Administrative)
Stellenbosch-Elsenburg College of Agriculture. Research stations and experimental farms: Elsenburg, Mariendal and Welgevallen (Stellenbosch), Langgewens (Morreesburg), Nortier (Lambert's Bay), Oudsthoorn, Outeniqua (George), Tygerhoek (Riviersonderend) and the Veld Reserve at Worcester.

(2) AGRICULTURAL TECHNICAL RELATIONS WITH FOREIGN COUNTRIES

1. CO-OPERATION WITH AFRICAN COUNTRIES

(a) SARCCUS conferences and meetings attended

Number of meetings	Number of officers
11	16

The Republic of South Africa, and the Department of Agricultural Technical Services in particular, is acting as host to SARCCUS member countries at these meetings more and more frequently.

(b) Visitors to African countries

Number of countries visited	Number of officers
7	16

(c) Visitors from African countries

Number of visits	Number of countries	Number of visitors
21	6	28

These visits were aimed mainly at gathering information on agricultural technical matters.

2. OVERSEAS VISITS

(a) Attendance at congresses, meetings and symposia

Number of meetings	Number of countries	Number of officers
55	19	50

A strong delegation, consisting of five officers from the Department and including the Chief Director: Horticulture, Dr J.C. Strydom, attended the 20th Congress of the International Society for Horticultural Science in Australia.

(b) Study tours and official visits

Number of tours	Number of countries visited	Number of officers
42	22	44

These tours included a goodwill visit, upon invitation, to Hongkong and Taiwan by the Secretary, Dr D.W. Immelman, accompanied by Dr C. van der M. Brink, President of the CSIR, and a visit by the Chief Director: Crops and Pastures, Prof. S.A. Hulme, to Israel, France, the Netherlands and the United Kingdom to investigate, *inter alia,* the development and organisation of research on agronomy and the financing of research.

(c) Scientific and other visits

Number of visits	Number of countries	Number of visitors
46	14	130

Numbers varied from single visitors to groups of 43 persons. One of the most important visits was that of Dr C. Porrero, Adviser to the Spanish Ministry of Agriculture, to promote co-operation between Spain and the Republic in agriculture.

(3) FINANCES

(a) EXPENDITURE (REPUBLIC) 1978/79

	Vote R	Expenditure R
Administration	11 163 100	11 367 794,36
Plant production promotion	11 515 800	11 115 069,16
Animal production promotion	21 284 400	21 371 615,49
Agricultural resource utilisation	12 165 000	11 147 667,95
Entrepreneur development	6 475 200	6 423 307,57
Supporting and associated services	9 241 500	9 329 779,72
Theft and losses		6 904,98
	71 845 000	70 762 139,23
Less: Internal charges	1 012 000	1 696 416,39
Total	**70 833 000**	**69 065 722,84**

(b) REVENUE (REPUBLIC) 1978/79

	R
Vaccine sales	1 833 115,66
Product sales	1 151 270,89
Lease of State property	148 492,04
Miscellaneous revenue	2 489 683,58
Total	5 622 562,17
Interest	15 635,28
Total	**5 638 197,45**

(c) EXPENDITURE (SWA) 1978/79

	Vote R	Expenditure R
Administration	347 000	218 749,68
Plant production promotion	384 000	114 430,07
Animal production promotion	2 878 000	3 009 913,44
Agricultural resource utilisation	2 116 000	1 461 062,65
Entrepreneur development	500 000	475 347,14
Supporting and associated services	52 000	37 047,22
	6 277 000	5 316 550,20
Less: Internal charges	5 000	5 140,57
	6 272 000	5 311 409,63

(d) REVENUE (SWA) 1978/79

	R
Vaccine sales	15 662,55
Product sales	240 497,68
Lease of State property	11 669,92
Miscellaneous revenue	118 104,69
Total	**385 934,84**

(4) BUILDINGS

MAJOR WORKS COMPLETED		R
Bloemfontein	Glen College of Agriculture: research building	686 100
Bloemfontein	Glen College of Agriculture: additional training and hostel facilities	492 000
Onderstepoort	Veterinary Research Institute: alterations to existing workshop	27 000
Pietermaritzburg	Allerton Regional Veterinary Laboratory	361 700
Potchefstroom	Potchefstroom College of Agriculture: office for State veterinarian	379 700
Uitenhage	Plant Protection Research Institute: Insectarium	64 000

MAJOR WORKS UNDER CONSTRUCTION		
Bloemfontein	Offices for State Veterinarian	290 000
Dohne	Dohne Agricultural Research Station: Animal Husbandry Research Buiilding	814 000
Irene	Animal and Dairying Science Research Institute: energy and metabolism building	61 000
Middelburg	Grootfontein College of Agriculture: administrative research building, abattoir and extension to agronomy building	880 000
Onderstepoort	Building for foot and mouth research	5 700 000
Pretoria	Soil and Irrigation Research Institute: additions	1 049 100
Pretoria	Agricultural Buildings: computer processing computer centre	5 700 000
Pietermaritzburg	Cedara College of Agriculture: Regional Head Quarters, lecture rooms and alterations to existing administration building	4 000 000
Stellenbosch	Elsenburg College of Agriculture: administrative research building	4 600 000
Stellenbosch	Plant Protection Research Institute: quarantine station, additional offices and laboratories	389 000
Vryheid	Offices for State Veterinarian	264 000

(5) NEW LEGISLATION

Subdivision of Agricultural Land Amendment Act, Act 12 of 1979

Plant Improvement Amendment Act, Act 10 of 1979

Groot Constantia State Estate Control Amendment Act, Act 11 of 1979